WESTERN GAS

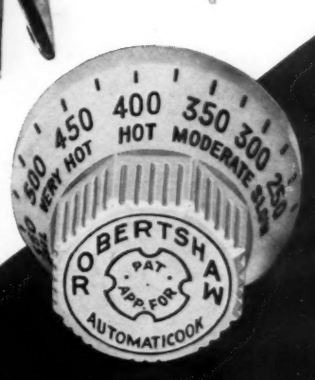
ROBERTSHAW

"Automati-Cook"

SEP -7 1934

LOOK

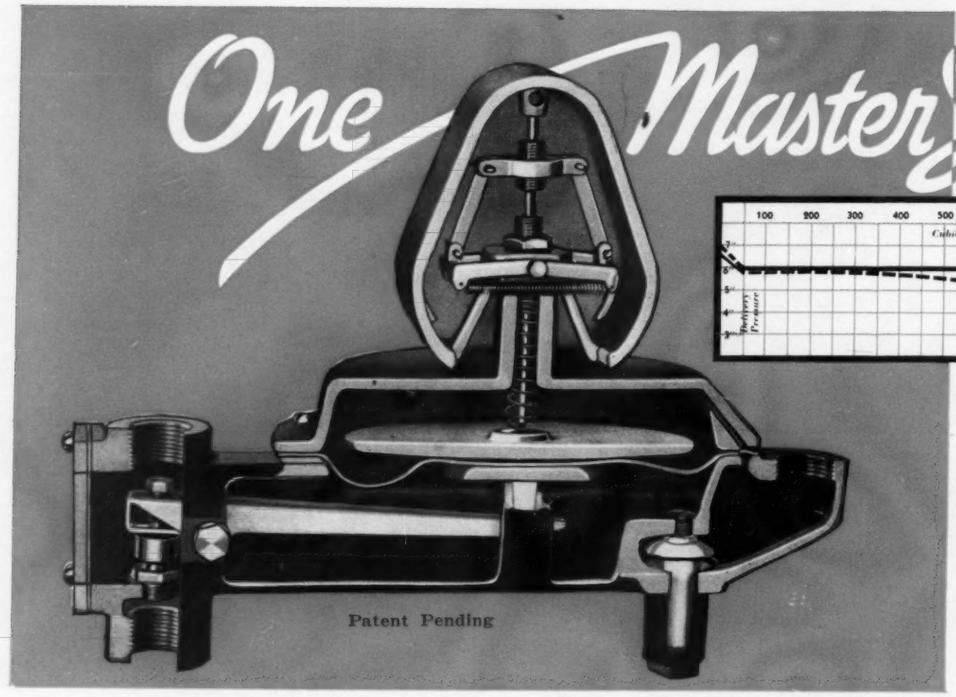
● That's a command. And thousands of women will follow it—eagerly—because it comes to them in the Robertshaw advertisements now appearing in The Saturday Evening Post. Are you ready to cash in on this advertising? With two million Robertshaw equipped gas ranges already in use—with Robertshaw advertising reaching three million able-to-buy families—the Robertshaw is a greater selling force for you this fall than ever before. Women know that controlled gas is the perfect cooking fuel—and they also know that the Robertshaw name on the dial is their assurance that the oven is under perfect control.

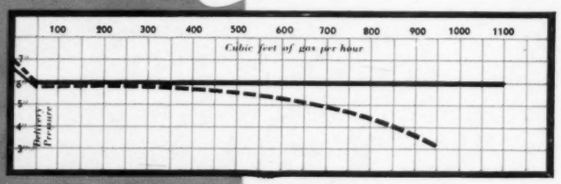


ROBERTSHAW THERMOSTAT COMPANY • Youngwood, Pa.

September 1934 ◆ ◆ 25 Cents

One Master Stroke





The graph tells the story. With the Evenflow Loader, the Mueller-Groble Regulator passed up to 1100 cubic feet of gas per hour without a drop in delivery pressure. The best condition obtained in testing many types of regulators without the loader, is 750 cubic feet per hour with a 1-in. drop from the set pressure.

. . . wipes out the greatest fault of house service regulators!

You know what that fault is—the inability of service regulators to maintain their set delivery pressure when called upon to pass a large volume of gas. Always a weakness of house regulators, this fault has presented an increasingly formidable problem as a result of the ever growing use of water heaters, conversion burners, and other modern gas appliances.

The device which corrects this fault—The Mueller Evenflow Loader—is as simple as it is effective. This Evenflow Loader has a two-fold advantage. It provides an easy means of giving your customers better service by holding a constant outlet pressure to all appliances regardless of sudden changes in volume. It also enables you to carry lower line pressures and reduce the ever-increasing unaccounted for gas. This is the only loading device offered to the gas industry that will maintain an even flow on inlet pressures of 10 lbs. or lower.

The graph tells the story better than words ever could. It shows the result of one of many tests which demonstrate the effectiveness of the Evenflow Loader. While it was designed for use with the Mueller-Groble style 50 and 55 Spring Type House Service Regulators, it is also adaptable to other regulators of this general class. Considering the service it performs, the cost of the Loader is inconsequential.

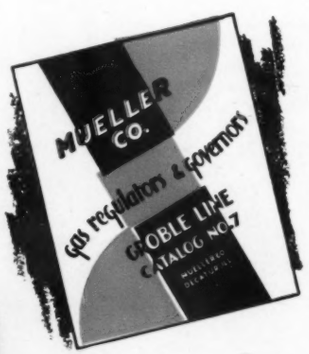
Try It Under Your Own Conditions

We will be glad to supply you with a Mueller-Groble Regulator equipped with the Evenflow Loader. This will enable you to demonstrate its ability to maintain a set pressure under the most abnormal load conditions. Write us, or ask the Mueller representative.

MUELLER CO., Decatur, Illinois

Factories: Decatur, Ill.; Chattanooga, Tenn.; Los Angeles, Calif.; Sarnia, Ont.
Branches: New York and San Francisco

MUELLER
GROBLE LINE
GAS REGULATORS and GOVERNORS



Ask for the new
(MAY 1, 1934)
CATALOG No. 7

It covers Service Regulators for every service; Low Pressure and Holder Governors; District, Automatic, Industrial and High Pressure Regulators; Relief Valves, etc.

The MODERN Clamp

. . . THE

GREATEST FORWARD STEP EVER ACHIEVED

IN BELL JOINT EFFICIENCY . . . . .

Laboratory and field results have definitely proved that the Dresser Bell Joint Clamp, Style 60, is so efficient that it eclipses any other device ever built for keeping bell and spigot joints tight.

A high minimum gasket pressure on the bell face and pipe spigot is assured for the first time. Along with this feature, Style 60 combines simplicity with sturdiness, adjustability with ease of installation, permanence with economy, laboratory proof with field proof.

To beat the efficiency of the Dresser Style 4½ HP Clamp, it was necessary to do more than offer a different design, or to provide mere adjustability. It was essential to produce in Dresser Laboratories a totally new type of testing apparatus that would reveal, scientifically and accurately, the relation of clamp design to performance. This presearch led to the Dresser Sealometer—the gasket pressure gage, which made possible an entirely new method of studying gasketed joints.

Thus the modern Dresser Clamp is the culmination of three years of development, and it effects a genuine advance in bell joint efficiency.

S. R. DRESSER MFG. COMPANY • BRADFORD, PA.

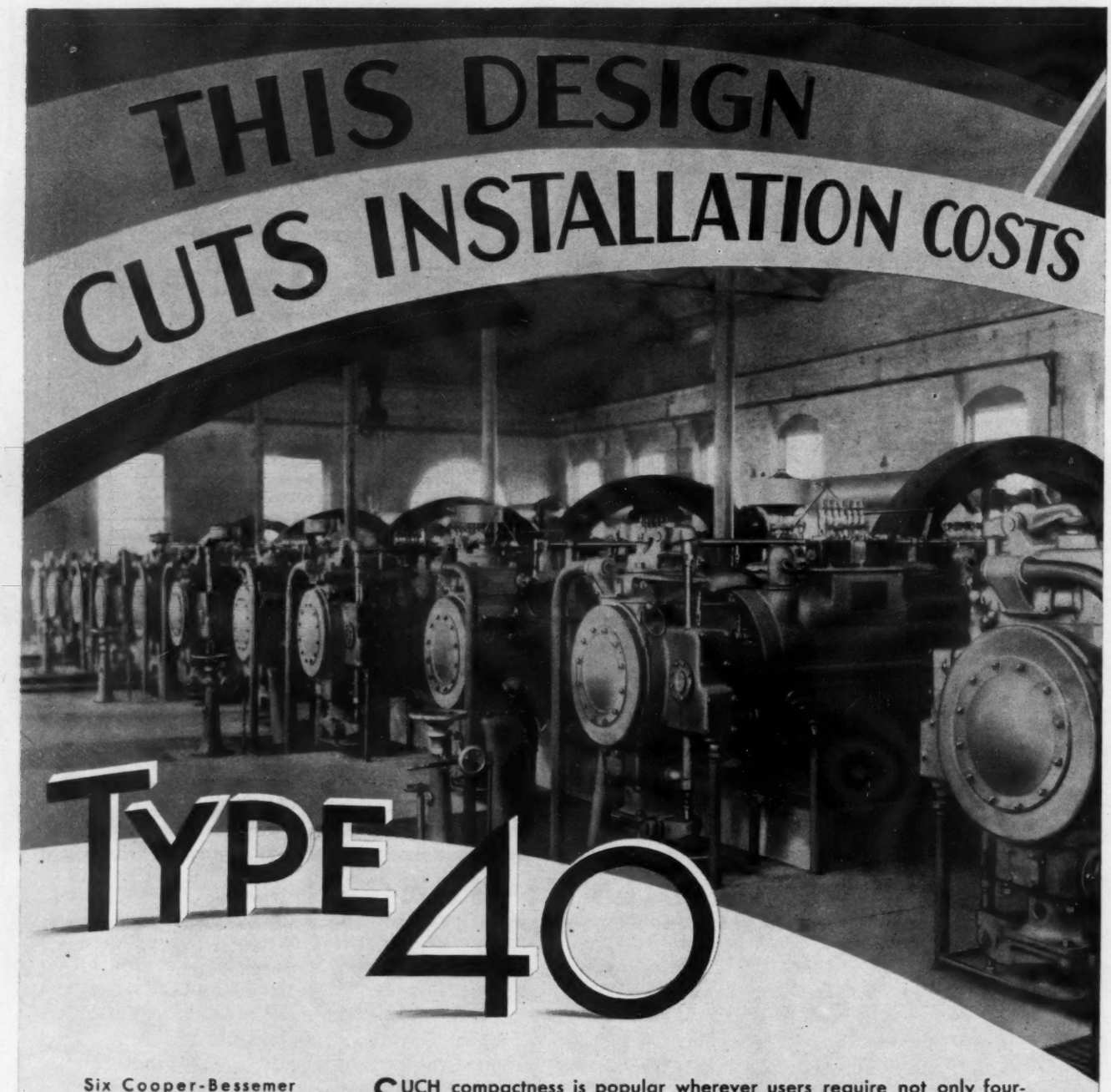
In Canada: Dresser Mfg. Company, Ltd. • 32 Front St., W., Toronto, Ontario

DRESSER

BELL JOINT CLAMPS

September, 1934. Volume X, Number 9. Western Gas is published by Western Business Papers, Inc., at 810 South Spring Street, Los Angeles, California. Subscription price (in advance) 25 cents the copy; $2.00 per year; 2 years, $3.00; $3.00 per year foreign. Entered as second class matter June 1, 1925, at the postoffice at Los Angeles, under the Act of March 3, 1879.

THIS DESIGN CUTS INSTALLATION COSTS



TYPE 40

Six Cooper-Bessemer Type-40, 400 H.P. twin gas engines each driving 23x11x20" compressor cylinders. Similar units are serving oil and gas companies in various parts of the United States.

WRITE FOR BULLETIN

SUCH compactness is popular wherever users require not only four-cycle economy but also great economy in initial cost. For example, Type-40 makes it possible to install 400 H. P. for very little more than it ordinarily costs to ship, unload, and erect 200 H. P. Where a new station is constructed to house these units, the cost is lower per horsepower for building, concrete and crane.

The general use of roller bearings reduces shut-down time for adjustments and greatly increases the overall mechanical efficiency.

THE COOPER-BESSEMER CORPORATION

640 East 61st Street . . . . . Los Angeles, California

PLANTS — Mount Vernon, Ohio — Grove City, Pennsylvania

The impact strength of this pipe is more than doubled

The experience of users for the past twenty months has confirmed in the field what a long succession of tests has consistently proved, namely, that Super-de Lavaud Pipe is endowed with extraordinary resistance to shocks encountered in handling, transportation and service. The impact strength of this pipe is more than double that of the centrifugal pipe we formerly produced. Users also report pronounced increases in toughness as well as ductility. Tests show more than 50% increase in elongation and notably greater ductility without loss of tensile or bursting strength. These important advantages are the result of a new technique in the centrifugal casting of gray iron, developed and patented by this company, whereby Super-de Lavaud Pipe is *cast without a chill in metal mold.* A booklet, available on request, gives complete data.

UNITED STATES PIPE AND FOUNDRY CO.
BURLINGTON, N. J.

Foundries and Sales Offices throughout the United States

U.S. SUPER-DE LAVAUD PIPE

IMPACT RESISTANCE INCREASED MORE THAN 100%

Linde Pioneering

in Welded Pipe Lines

is a Never-Ending Quest

1914—FIRST WORLD'S FAIR to be completely supplied with high pressure gas was the Panama Pacific International Exposition at San Francisco. This gas line, some 15,000 feet of 8-inch steel tubing was oxy-acetylene welded throughout. The wonderful results of this pioneer effort in welding pipe were acclaimed with the greatest enthusiasm.

On the 75th Anniversary of the Oil Industry Linde Leadership Marks Progress with New Achievements

IN THE 75-year history of oil one of the outstanding developments has been the rapid growth of welded pipe lines. Though comparatively young when contrasted to the industry as a whole, this process of joining pipe has made rapid strides since its inception a little over 20 years ago.

Early Projects

Oxwelding of overland pipe lines first attracted the attention of the world in 1914, when it was used for the construction of high pressure gas mains at the Panama Pacific Exposition at San Francisco. Previous to this an 11-mile gas line was laid in 1911, south of Philadelphia.

First Oil Line Welded in 1920

The Prairie Pipe Line Company was first to adopt welding as standard for its lines. This pioneer effort was started with Linde products in December, 1920, with the laying of a 15-mile, 8-inch oil-carrying line from Bartlesville, Okla., to the Cherokee Station, near Ramona, Okla. A little later this company laid the first long welded oil pipe line in the United States, 140 miles from Mexia to Hensley, Texas.

For his original work in connection with these two projects, Mr. N. E. Wagner, Superintendent of Welding for the company, was awarded the Morehead Medal by the International Acetylene Association in 1923.

Original Lines Still in Service

Today, these first oil lines welded by the oxy-acetylene process are still rendering satisfactory service . . . operating almost continuously.

Welding Quickly Spreads

From these early beginnings oxy-acetylene welding and cutting has quickly superseded older methods of laying pipe lines. In 1924, the size of pipe being welded was increased from 8- and 10-inch oil lines to 16- and 18-inch gas lines welded by the Magnolia Gas Company and then to 20-inch by that company and the Lone Star Company in the following year or two. From then on, larger and larger pipe lines were welded up to the 26-inch lines of today. These lines that carry oil, gasoline and gas from the fields to the refining plants or city mains are sometimes over a thousand miles long. They are buried in ditches on land, but frequently they have to be laid across river-bottoms or swamps and in the sea. Needless to say, the thousands of joints in these lines have to be absolutely leakproof otherwise, valuable gas and oil would be lost, and miles of pipes would have to be dug up for repair.

Standard Construction Today

Today, practically every important pipe line is welded. Welding is the proved and accepted method with leading pipe line companies and contractors. They know that once a pipe joint has been welded and tested, it will last as long as the pipe itself. Striking proof of this has been found when terrific floods or earthquakes have torn and broken the pipe itself without as much as cracking the welded joints. Many times welded pipe lines were the only ones not completely torn apart and ruined.

Linde Constantly Fosters Progress

Much of the progress of oxy-acetylene welding and cutting in pipe line construction has been fostered by The Linde Air Products Company. Linde engineers are constantly striving in a never-ending quest for improvement in welding and cutting techniques, materials, rods, gases and equipment.

Develops Speed Lindewelding

Linde developed Lindewelding—a new technique—that doubles or triples the daily production of sound welded joints. It assures stronger pipe joints through a better and faster method of oxy-acetylene welding. It saves 35 to 40 per cent in materials, 30 to 60 per cent in time.

Lindewelder Increases Production

The Lindewelder was another improvement brought out by Linde. This appliance further increases the speed of Lindewelding, and makes the operation almost automatic. Other advances include the Multi-Flame Head for Lindewelding and the Wagner Pipe Cutting Machine for cutting and beveling pipe in the taking up and reclamation of old pipe lines.

Uses of Welding and Cutting Limitless

Oxy-acetylene welding and cutting may be truly termed the process of a thousand uses. In addition to its wide field of application on pipe lines and gathering systems, it is also used extensively for the erection of storage and gasoline plants and in refineries. Typical applications include: heat exchangers, piping of all sizes, vapor lines, condenser lines, structural steel work, absorbers, coils in cooling towers.

Oxwelding and cutting effect large savings in repair work and the salvaging of old equipment and abandoned pipe lines.

The oxy-acetylene blowpipe also is used to hard-face cutter bits and other equipment subject to wear. A coating of wear-resisting metal such as Haynes Stellite, Haystellite Composite Rod, High Strength bronze or High Test steel on the points of wear increases the productive life of parts 2 to 10 times.

March of Progress

Woven into the seventy-five year's history of the petroleum industry is the pioneering work done in the past two decades by the men who typify Linde Process Service. It is a truism that the important advances made in any industry during its continued growth are due as much to the unselfish efforts of men as improvements in materials and processes.

What is Linde Process Service?

Linde men on the firing line exemplify and crystalize a service rendered above and beyond the purchase of tangible goods. They are the direct contact in the field. They work closely with users of Linde Oxygen, assist them in training and qualifying operators and help organize the most efficient welding operations. Yet, this is only the visible evidence of what Linde Process Service means. Linked to the army of service operators are the combined efforts of scientists, engineers and metallurgists constantly working toward improvements in welding technique, materials and apparatus.

Back of the service operators come service supervisors, resident engineers, consulting, development and research engineers. Their work is highly important. Hundreds of practical and theoretical problems in metallurgy and in the application of the oxy-acetylene process for pipe line work are constantly studied by these men. The results of these studies enable Linde service operators to give greater service to Linde customers by bringing to their jobs the latest and best pipe line welding methods.

Linde Cooperation Continuous

Linde has a continuing interest in its customers. It exerts every facility to assure them the highest satisfaction and most profitable use of the Linde products they buy. The nearest Linde Sales Office will be glad to tell you how Linde Process Service can be of help to you. Without cost or obligation, it will gladly furnish complete data to users of Linde Oxygen on welding piping methods. It will make available also such further technical assistance your engineers or construction men may require. Linde Sales Offices are located at Atlanta, Baltimore, Birmingham, Boston, Buffalo, Butte, Chicago, Cleveland, Dallas, Denver, Detroit, El Paso, Houston, Indianapolis, Kansas City, Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Phoenix, Pittsburgh, Portland, Ore., St. Louis, Salt Lake City, San Francisco, Seattle, Spokane, and Tulsa. Everything for oxy-acetylene welding and cutting—including Linde Oxygen, Prest-O-Lite Acetylene, Union Carbide and Oxweld Apparatus and Supplies—is available from Linde through 126 producing plants and 859 warehouse stocks.

The Linde Air Products Company

Unit of Union Carbide and Carbon Corporation

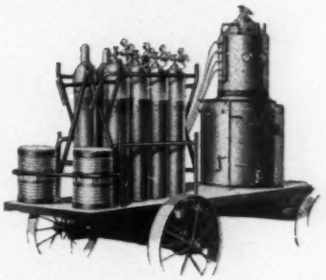
UCC NRA CODE

In Canada, Dominion Oxygen Co., Ltd., Toronto

PRODUCT OF A UNIT OF UCC UNION CARBIDE AND CARBON CORPORATION

You are cordially invited to visit the welding demonstrations and the numerous other exhibits sponsored by the Corporation in both the Basic and Applied Science sections in the Hall of Science at Chicago's 1934 A Century of Progress Exposition. Here you will see how users of oxy-acetylene welding and cutting, and other products and processes developed by Units of Union Carbide and Carbon Corporation benefit from a most unique coordination of scientific research with manufacturing, sales and service facilities.

You can order everything for Pipe Line Welding from Linde



LINDE OXYGEN . . . available in any amount from plants and warehouse stocks in all industrial centers.

PREST-O-LITE ACETYLENE . . . ready to use—the standard dissolved acetylene for well over a quarter of a century.

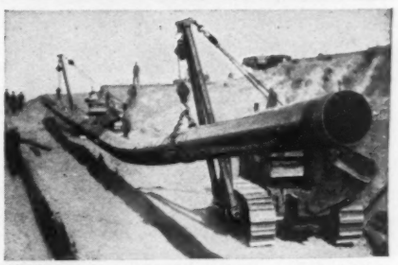
OXWELD APPARATUS AND SUPPLIES . . . Oxweld offers the maximum value in oxy-acetylene equipment. Blowpipes, regulators, acetylene generators, welding rods, and supplies—are available for every welding and cutting operation. Complete stocks and service stations are located in all principal cities.

UNION CARBIDE . . . sold in the familiar Blue and Grey drum from over 250 warehouse stocks.

· HIGHLIGHTS IN WELDING HISTORY ·

1920—MAKING HISTORY—The last weld being made at Cherokee Station, near Ramona, Okla., on the first oil line to be welded. This 15-mile, 8-inch line is still giving satisfactory service.

1921—FIRST LONG welded oil pipe line in the United States, 140 miles from Mexia to Hensley, Texas. Today, this line is still on the job and many thousands of miles of welded pipe lines cover the country.



1930—NORTH TO SOUTH—On the 24-in. gas pipe line from Amarillo, Texas to Chicago, Ill., oxy-acetylene welding did its part to assure a long-lasting job on such a huge undertaking.

1931—OVER THE MOUNTAINS—On the longest 26-in. gas line, laid over the mountains between Kettleman Hills and Los Angeles, Lindewelding set a record for fast daily production of sound welded joints.

1934—NEW SPEED RECORDS—At the Tulsa Oil Show this Spring, new speed records in welding were chalked up. With the Multi-Flame Lindewelding Head welds were made in 12-in. standard ¼-in wall pipe in 7½ to 8 minutes.

IN ACTION—Out in the field we see the Multi-Flame Lindewelding Head setting new records for fast production on pipe lines. Better, stronger welds in less time, less material and least cost.

REVIEW of the MONTH

Government-Sponsored Building Activity . . . A Market Opportunity

GAS new business departments as well as gas equipment manufacturers should keep their eyes on government-sponsored building activities these days. A wave of building and modernization work on a nationwide front may follow recently launched federal projects, and this activity must not catch the gas industry unprepared. Those who are alert will get in touch with local offices of government housing and financing agencies without delay.

Buildings have depreciated in the depression years (three out of five homes are said to be in need of extensive reconditioning); living standards have dropped; the country's building and materials trades are idle; individual savings have dwindled to a point where they cannot be expected to finance rebuilding on any general scale. These conditions call for a radical loosening up of credit for building improvement, and several newly created government agencies are now coming forward with programs for the purpose. Financing is now available on easy terms, and certain classes of gas equipment should find definitely improved markets as a result.

The Federal Housing Administration, created under the National Housing Act, is now enabling established financial institutions to make character loans for modernization or repair purposes to property owners (individuals or firms) who have sufficient assured income to carry the loans on the liberal terms provided. No collateral is necessary, nor are co-signers required. Loans from $100 to $2,000 are available to improve any one property. Charges run $5 per $100 on the face of a one-year note, deductible in advance; longer term credit costs in proportion.

Details of the Federal Housing Administration plan are available at district offices of the Administration, and those concerned with gas load-building should be familiar with them. To be included in improvements which may be financed by these government-insured loans, housing equipment must be classed as "built-in" or "non-detachable." Under date of August 18 the Federal Housing Administration has issued a list of equipment considered as "built-in," on which appear the following items of interest to the gas industry:

Non-detachable heating systems and equipment (coal, wood, oil, gas or electricity).
Domestic water-heating equipment, if non-detachable.
Heating control devices.
Incinerators and other garbage disposal systems.
Lighting fixtures, if integral part of wiring or gas system.
Radiation, if part of heating system, including valves and accessories.
Individual gas-making machines and equipment.
Air-conditioning equipment, if built-in.
Humidifying equipment, if built-in.
Built-in ventilating equipment, including fans.
Forced heat circulating equipment.
Kitchen units, including ranges and refrigerators, if built-in.
Built-in refrigerators, including automatic refrigeration.
Plumbing equipment, including tubs and showers.

These items are typical of the equipment which under the Modernization Credit Plan of the Federal Housing Administration is considered "a part of the real estate when installed." Other equipment of like characteristics will also be included, and the Administration will rule on any specific item on which questions arise. Such items as detachable gas and electric heaters, and ranges which are not built-in, of course do not qualify.

In general, the facilities of the Federal Housing Administration are for individuals and firms whose credit is in good standing. Another government agency, the Home Owner's Loan Corporation, which deals primarily in re-financing for distressed properties, has recently established a Reconditioning Division. Housing equipment under some conditions may be financed through this agency, at least insofar as concerns repairs to or improvement of existing equipment. Mortgages held by the Home Owners Loan Corporation usually run for 15 years, with monthly payments of $7.91 per $1,000 amortizing the loan and the 5 per cent interest charged.

Of significance for new building are two other divisions in the government's housing and lending agencies. The Federal Home Loan Bank system which will loan up to 50 per cent on mortgages held by affiliated mutual savings and building and loan associations, aspires to loosen up large quantities of credit for new building. The Housing Division of the Public Works Administration will deal with low cost housing or slum-clearance projects, and correcting acute housing shortage conditions; it is not concerned with individual ownership needs.

Also worthy of passing notice is the program of the Division of Subsistence Homesteads, Department of Interior. Demonstration "small farm" projects are being set up at numerous points by this agency as an experimental step toward decentralization of industrial population. Many of these projects are eligible for natural gas or liquefied gas service and will represent appliance markets.

The dollar which goes into new building or modernization goes 70 per cent to workmen, and from their hands into the general channels of trade. Everyone stands to benefit from cooperating in the government-sponsored building program; it represents an important opportunity for putting new gas equipment to work. It is encouraging to note that most of the government activity is proceeding through established avenues, and that it contemplates increasing business for banks, building and loan organizations, contractors, materials and equipment firms, as well as the essential reemployment of labor.

TVA Still in the Headlines

TO THOSE interested in the career of the Tennessee Valley Authority we commend the A. G. A. Information Service No. 121, issued August 18. Managing Director Alexander Forward reports a conference of gas industry representatives with TVA Director Lilienthal, held last month. Judging from the conference there is no prospect of relief for gas companies confronted with government-financed electric appliance competition.

A recent Alabama Public Service Commission ruling also makes good reading; the Commission, while deeming it outside its province to pass upon broader aspects of the TVA, finds the Authority to be engaged in business in Alabama as a utility, and "subject to reasonable exercise of the police powers of the State, as if an individual." A supplemental order was issued requiring the Authority to file its rates and service regulations with the Commission and to comply otherwise with State law.

Action on Michigan Gas Line

AN IMPORTANT Michigan natural gas development, delayed while natural gas reserves of the state were under survey, is now definitely calendared. American Light and Traction Co. will construct its 55-mile 8-inch line from the Austin pool in Mecosta County, southwest to Muskegon. American-Michigan Pipe Line Co., newly formed subsidiary, will operate the line, according to C. N. Chubb, president. Dean W. Flowers, Muskegon Gas Co. executive, is vice-president and general manager of the newly formed pipe line unit. Right-of-way has been acquired and construction will begin within 60 days, United Light and Power Engineering and Construction Co. holding the contract to lay the line.

Reproduction of the micrograph above shows the interlocking of the flakes of the internal reinforcement used by Barrett. By laminating with the waterproofing agent they give Barrett Pipe Line Enamels unusual toughness and resistance to soil stresses.

For pipe of large diameter, The Barrett Company will furnish equipment required to revolve pipe and spread enamel.

Reconditioning Time can be postponed for many years when you protect lines with

Climate, moisture, earth acids, electrolysis, and soil stresses eventually make it necessary to recondition any pipe line. But the tough film of Barrett Pipe Line Enamels—immune to moisture and earth acids and a non-conductor of electricity—gives long-lasting protection against all forms of corrosion, reduces maintenance costs and puts off reconditioning many years. Behind Barrett Pipe Line Enamels stand eighty years of successful experience in the production and development of coal-tar protective coatings. Barrett offers the cooperation of a Technical Staff and the service of Field Engineers in matching the coatings with the job and suggesting the most efficient and economical methods of application. 'Phone, wire or write.

Barrett Specification

PIPE LINE ENAMELS

THE BARRETT COMPANY, 40 Rector Street, New York, N. Y.

TRUST YOUR OWN COST RECORDS

● From time immemorial the question of purchasing new meters versus continued repair of old types has been debated from the standpoint of policy. ● Policies differ. But the economics do not. Your own cost, based on accurate meter records, will supply the answer. ● It is from the angle of simple economics . . . cost per meter year or per MCF and actual return on your meter dollar . . . that progressive gas company executives are weighing these factors: 1. The higher capacity ranges of modern American 5A or 5B meters . . . 2. The higher degree of accuracy and longer accurate life due to advanced design and new developments in materials and construction . . . 3. Minimum repairs and the control of replacements on an economic basis. ● American meters give you a further distinct purchasing advantage: they are priced to encourage modernization.

. . . also RELIANCE REGULATORS for close pressure control and positive lock-up.

AMERICAN METER COMPANY
INCORPORATED
Measurement and control of Gas, Oil, Steam, Air and Liquids
ESTABLISHED 1836

Meter Trade Names:
AMERICAN — D. McDONALD — METRIC — MARYLAND — PACIFIC — TUFTS

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Los Angeles Philadelphia Pittsburgh New York San Francisco Tulsa

183

ADVERTISERS' INDEX

American Gas Products Corporation 60
American Meter Company 8
American Stove Company —

The Barber Gas Burner Co. 61
The Barrett Company 7
H. R. Basford Company 58
Blaw-Knox Company 63

The Cast Iron Pipe Research Ass'n. 58
The Chaplin-Fulton Mfg. Co. 64
Coast Counties Gas & Electric Co. 53
The Cooper-Bessemer Corporation 2

Dearborn Chemical Company 62
The Denver Fire Clay Co. —
S. R. Dresser Mfg. Company 1

Electrogas Furnace & Mfg. Co. 63
Electrolux Refrigerator Sales, Inc. 33
The Estate Stove Company 31

Fluor Corporation, Ltd. 35
The Foxboro Co. 37
Fraser Furnace Company 58

General Ceramics Company 59
James Graham Manufacturing Co. —

Islas Coronado Yacht Club 61

Johnson Gas Appliance Co. 63
Johns-Manville 27
Jones & Laughlin Steel Corp. 3rd Cover

Kerotest Mfg. Co. 42

The Linde Air Products Company 4, 5
Los Angeles Gas and Electric Corp. 51

Merco Nordstrom Valve Co. 60
Minneapolis-Honeywell Regulator Co. 57
Mueller Company 2nd Cover

The National-Superior Co. —
National Tube Company —
Natural Gas Equipment Inc. 59

Oxweld Acetylene Co. 4, 5

Pacific Coast Gas Association 25
Pacific Gas and Electric Company 48, 49
Pacific Gas Radiator Co. 62
Payne Furnace & Supply Company 45, 55
Pittsburgh Equitable Meter Co. 60
Pressed Steel Tank Company 41
The Prest O-Lite Co., Inc. 4, 5

Reliance Regulator Corporation 46
Republic Steel Corp. Back Cover
Reynolds Gas Regulator Company 39
Robertshaw Thermostat Co. Front Cover
Ruud Manufacturing Co. —

Safety Gas Main Stopper Company 55
San Diego Consolidated Gas & Electric Company 53
Wm. B. Scaife & Sons Co. —
Southern California Gas Company 51
Southern Counties Gas Company 51
The Sprague Meter Co. 57

Union Carbide & Carbon Corp. 4, 5
Union Carbide Sales Co. 4, 5
United States Pipe and Foundry Co. 3
Utility Development Company 43

Ward Heater Company 39
The Welsbach Company 29

WESTERN GAS

"Reg. U. S. Pat. Off."

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Contents for September, 1934

Review of the Month 6

Pacific Coast Gas Association Officers and Directors 10

41st Convention Call 11
By George P. Egleston

A Utility Cashes in on Distribution Employee Contacts 12
By W. M. Henderson

Friction Factor for the Stanpac Natural Gas Line 14
By Frank Wills

Program for 41st Annual P. C. G. A. Convention 18

Cooperation Is Selling the Modern Gas Range in Chicago 21
By Craig Espy

ABSTRACTS 22
Distribution 22
Plant Practice 24
Transmission 26
Utilization 28
Domestic Sales 32

BUTANE-PROPANE NEWS 40
Substituting Butane for Oil Gas at Needles 40
By D. E. York

MEASUREMENT AND CONTROL 47
Recent Progress in Fluid Measurement by Orifice Meter . . 47
By William L. Cowan

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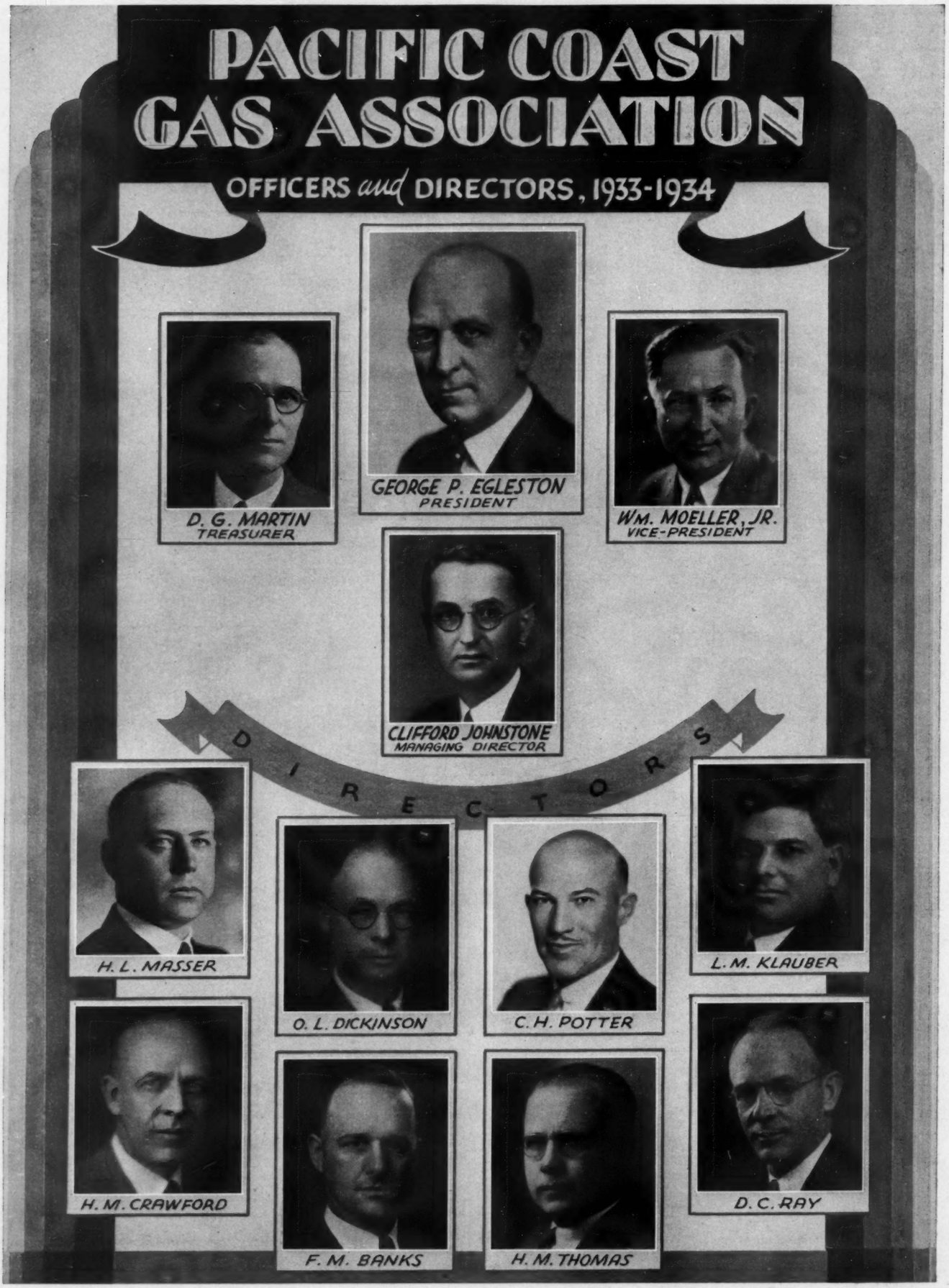
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September, 1934

WESTERN GAS

"Reg.U. S. Pat. Off."

Vol. X, No. 9

A Monthly Journal of the Gas and Gas Appliance Industries in *Western America*

41st Convention Call Heralds Sessions at Del Monte

AGAIN it is the privilege and the extreme pleasure of the Pacific Coast Gas Association's officers to extend to the membership a most cordial and urgent invitation to attend an Annual Convention, to give us the benefit of your counsel and advice and to participate in and profit by the work which is being carried on by your Association.

This year's convention will be held at Del Monte, beginning with Committee meetings on Monday, October 8, continuing with general sessions through Tuesday, Wednesday and Thursday, and terminating with the annual golf tournament on Friday.

PERHAPS at no time in the history of your Association has there been greater need for a thorough review of industry problems and the preparation of a carefully considered program for the future. Economic stress is being felt alike by the utility companies, appliance manufacturers and appliance dealers. Operating problems must be solved if the gas industry is to continue its leadership in the public service. Technical studies have been and are being made to enable the industry to meet the constantly increasing competitive pressure.

To all of these various phases your committees have been devoting their time and sincere efforts during this past year, and the reports of the results of their activities will not only be highly interesting in themselves but will also provide a basis for much helpful discussion.

YOUR officers and Section Chairmen have worked earnestly and painstakingly to provide a program which we feel sure will prove most interesting and highly constructive. While the serious business of the convention has been kept well in mind, the lighter features of entertainment have not been lost sight of, and the program as a whole is one which we present for your edification and enjoyment with our most cordial endorsement.

And let us not overlook the opportunity given us by this annual get-together to again renew those fellowships which are such vital factors in the well-being of our industry, to the advancement and betterment of which we have dedicated our services and which is alike our means of livelihood, our problem and our joy.

GEORGE P. EGLESTON
President
Pacific Coast Gas Association

A Utility Cashes In On Distribution Employee

By W. M. HENDERSON
Superintendent of Gas Distribution
Los Angeles Gas and Electric Corporation

THE gas industry must bid for public acceptance if it is to function as the Community Fuel Bin. "If it is done with heat, you can do it better with Gas" is a sound slogan. To make it effective requires constant repetition, frequent presentation, and continuous demonstration.

W. M. Henderson

It is as difficult now as ever to get the public's attention, what with social scandals, sex problems, public enemies, movies, and general gossip; so it is unreasonable to expect public attention to be centered on the matter of fuel, let alone the subject "gas."

Advertising is the recognized effective weapon to maintain interest, once the subject is made popular. Popularity is the basis of business success, for the public dearly loves to buy a popular article. Our difficulty is to catch the public's fancy and get them tuned in on modern gas appliances. The public reads the advertisements featuring subjects on which there is personal interest or knowledge. A salesman will sell most effectively when the customer acknowledges need, interest, or desire; that is, when experience or conversation with others has interested the prospect in the article. For the salesman to originate the interest, the resistance is great and the sales expense may be prohibitive.

Something simple and effective is essential to make the advertising efforts and sales expense both productive and profitable. The "something" which balances the equation is available within the industry; and the beauty of it all is the fact that it is now a necessary and recognized expense that every gas company must maintain. With very little effort it can be utilized to do double duty; when fully developed it can be made self-liquidating; that is, it can be made to compensate for its expense by the business it creates.

That "something" is the latent force which now lies dormant among employees engaged on customer service contacts, for they are in a position to stimulate interest of consumers in modern gas appliances.

Since business has become such a scramble for the customer dollar, the public has been educated to a lot of new ideas for spending, which makes it just a little harder to interest them in modern gas appliances. Now comes federal aid to the support of our competitor: electric service, financing construction of additional capacity, subsidizing manufacturer and distributor of appliances, and extending three- to five-year credit arrangements to purchasers.

AT RIGHT:

Large signs at exit and entrance to distribution department yards carry the current sales promotion slogan, as seen in view at right. The slogans are also printed on stickers for use on windshields of department employees.

It is public fancy that will tip the balance in favor of gas or its competitors. Fancy is often predicated upon the accepted public authority, *"They"*—an intangible somebody credited with authority on all issues. Every individual is a potential *"they,"* and may be set up as an authority when quoted; so frequently innocent remarks may have far-reaching effect.

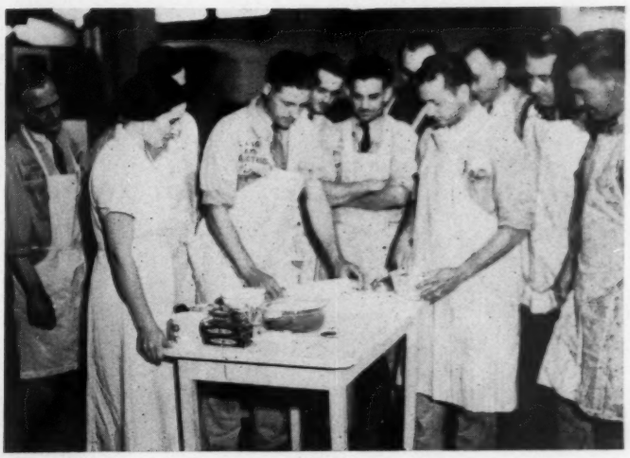
The grand tactics in the sales offense is to capture the acceptance and endorsement of the general public. It is sufficient that our public have a speaking knowledge of modern gas appliances. Their occasional conversation with neighbors and friends, at which times favorable comment is made on the convenience, economy, or speed of gas appliances, is the origin of a multiplicity of similar statements passed on from speaker to listener, all predicated on the introduction, "They say . . . "

So "They," is our objective, and since every consumer—in fact, every human—is a potential "they," the most effective line of attack is through the aid of the customer contact men; such men as remedy complaints, work high bills, or set and turn on meters. These men enter the consumer's premises at the request of the consumer, to perform some essential service. The consumer not only appreciates the deed but, in some measure, feels obligated. She also realizes that the service man is supported by the work he performs. In this respect he has an advantage over a salesman, for any counsel on gas appliances given by the service man is not accepted as so much "sales talk" but as real confidential advice from a man who should know.

Such a relation between service man and consumer is ideal as a sales auxiliary. It is the means for creating the initial interest in modern gas appliances. The salesman, supported by advertising, will do the rest.

Employee interest in sales promotion is the least difficult of the obstacles to be overcome in a load-building campaign. He will readily recognize that his participation is a matter of self-preservation. If the future of the gas industry is the stake, then the employee, in proportion to his interest in the business, has the

Contacts



AT RIGHT:

L. A. Gas and Electric Corp. class in domestic cooking for distribution department employees, conducted by Victoria Warner, company home economist.

AT LEFT:

Another cooking class session. Course consists of eight lessons two and a half hours each, instruction being given to groups of 12 men.

most to lose if the business goes into a tail-spin. If the business progresses by his participation in sales promotion, he stands to profit; first, by assurance of employment, then by prospects of advancement.

To convince an employee of the need for action on his part, we need but exhibit the case of the iceman, or the platform men on the street railway. In neither case was there any effort made by the employee to stimulate business—evidently it was considered a responsibility of management. Now, when it is too late, the iceman realizes his fate, registers interest, and tries, personally, to keep his customers.

Because of this evident employee benefit, there is no need to offer inducements to cultivate active interest in sales promotion. In fact, the adoption of a bonus, or commissions, as a stimulant may be misconstrued as acknowledgement that the sole benefit of sales promotions is to accrue to the company.

A fact that need not be overlooked is this: Customer service employees are an expense. True, the cost of such service is included in the rates, but nevertheless, it is worth the effort to realize some tangible benefit by the promotion of sales through these service contacts with customers. It is rather an unique situation enjoyed by the gas industry in being privileged to contact its customers at their request at frequent intervals. What an ideal "set-up" for sales effort! The company that fails to avail itself of such an opportunity does not do justice to itself, the consumer, nor the employee.

In the drive for business, it is easy to stimulate the interest of the employee, but effective results required a certain amount of planned instruction under competent leaders.

The procedure followed in the Los Angeles Gas and Electric Corp. Gas Distribution Department has proved effective in improving service to consumer and developing sales ability of employees. The directing of this activity was assumed by R. C. Terradell, an experienced gas distribution man familiar with both service and sales. An outline of sales activities for the Department was prepared, and, with this as a guide, progress is being made.

First, a course in selling. For this purpose the American Gas Association's "Domestic Gas Salesmanship Course" was selected. This consists of six major topics, as follows:

Unit No. 1. Finding out the Consumer's Requirements.

Unit No. 2. Making the Easy Sale.

Unit No. 3. Convincing the customer.

Unit No. 4. Making the Difficult Sale.

Unit No. 5. Building the Gas Load.

Unit No. 6. Reaching out for New Business.

Each book was divided into a series of lessons, the text of each prepared in brief and mimeographed for distribution, with such other relevant data as were deemed necessary, to the class members.

There are approximately 270 men enrolled. Each class assembles one hour a week, either between 8:00 and 9:00 a.m. or 4:00 and 5:00 p.m. Attendance at class is a part of the day's work, paid for by the company.

Class instruction consists of (1) lecture on fundamental sales principles and the benefits of modern gas appliances, (2) general discussion, (3) sales demonstration, and (4) an occasional written test.

Supplementing the sales instruction and next in order is a class in domestic cooking. This latter idea was adopted as a result of the very favorable results obtained from a similar school for metermen conducted by the Portland Gas & Coke Co. Miss Victoria Warner, home economist and conductor of cooking schools for the New Business Departmental activities of the Los Angeles Gas and Electric Corp., acted as class instructor, assisted by Miss Pauline Ferrell. A group of 12 men constituted a class. Eight lessons of 2½ hours each were spread over two months' time. The men worked in pairs, on a modern range. Each man was required to perform all the duties necessary to prepare a complete dinner; mix and bake bread, cake, pies, and puddings. The demonstration was accompanied by a lecture, and many of the tricks of the kitchen and the proper operation of the gas range were disclosed. At the conclusion of eight lessons the men were subjected to a written test covering the field of subjects demonstrated.

These two courses polished up the service men so that they can converse intelligently with any housewife on problems in the culinary art. What an advantage this has proved! Service rendered on appliances has improved, and the customers' interest in the convenience of gas service and the benefits of modern gas appliances has been secured.

(Continued on Page 62)

The Friction Factor *for the* Stanpac Natural Gas

THE friction factor of the Stanpac natural gas transmission pipe line is of interest because of the Reynolds number at which this line is operated is higher and the type of construction is different than for older and smaller lines for which factors have been published. The gas entering the line has from time to time carried considerable water vapor, and traces of corrosive gases, which have roughened portions of the inner surface of the first 25 miles where condensation occurs. Certain corrective measures have been taken which have reduced but probably not entirely eliminated the corrosion. The variation of the friction factor throughout the life of the line is important from an operating viewpoint and demonstrates the futility of estimating too closely at the time a transmission system is designed. This detailed study of the friction factor of this line is a part of a program to investigate the effects of the corrosion, to follow its progress, and determine what further correction is necessary.

TABLE NO. 1. EQUIVALENT LENGTH FACTORS BASED ON RATIOS OF $(I.D.)^5$

Nominal Pipe Diameter	Actual Internal Diameter	$(I.D.)^5$	Equivalent Length Factor to 26-inch $(I.D._{26})^5/(I.D.)^5$
16	15.50	894,660	Multiply by 11.472
20	19.4375	2,774,600	Multiply by 3.6992
20-inch meter tube	19.301	2,678,500	Multiply by 3.8318
22	21.375	4,462,000	Multiply by 2.3003
24	23.3125	6,885,600	Multiply by 1.4906
26	25.25	10,263,800	Multiply by 1.0000

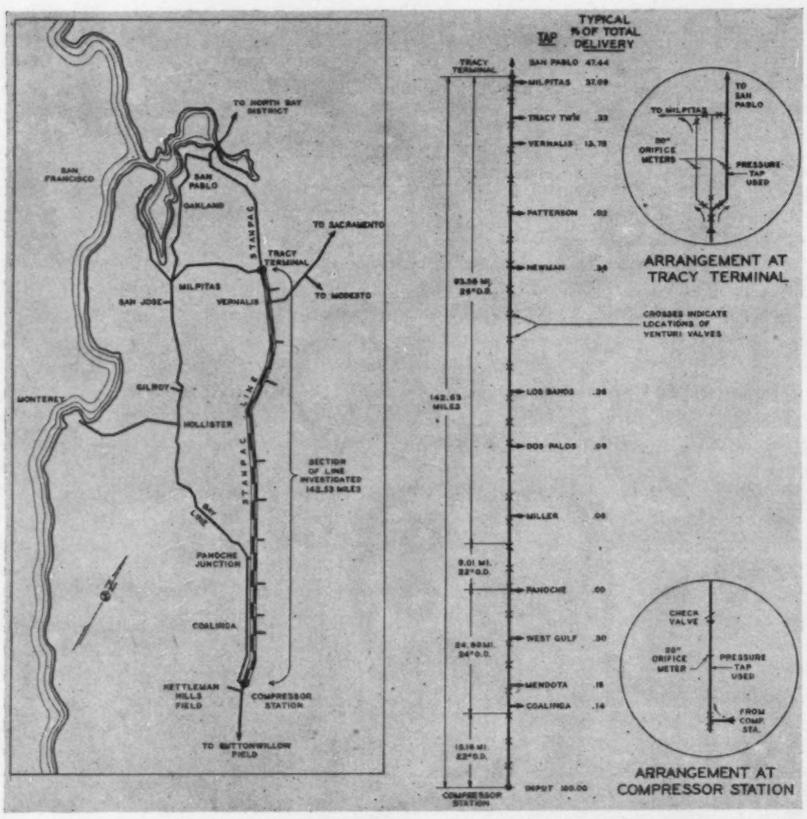


FIG. 1. Location and details of Stanpac natural gas line.

The portion of the Stanpac Line between the upstream orifice meter taps at the Kettleman Hills Compressor Station and the Tracy Terminal Meter Station was selected for investigation since it was sufficiently representative of the type of construction and offered the least amount of complication and the most accurate information. Fig. 1 shows the location of the pipe line and principal fittings. This pipe line is 142.53 miles in length and consists of 24.17 miles of 22-inch, 24.80 miles of 24-inch, and 93.56 miles of 26-inch pipe. A few feet of 20- and 16-inch pipe at the metering stations are included in the 22-inch section. The joints are 40 feet apart and are electrically welded over a chill ring inserted inside the slightly belled ends of the pipe. A valve is installed every 5 miles of its length. These valves are lubricated venturi cocks and were all made to fit 22-inch pipe. Consequently, on each side of each valve in the 24- and 26-inch sections there exists a 20-foot length of 22-inch pipe and a tapered swedge piece to 24- or 26-inch, according to the size of that section. Other special fittings and shapes causing additional losses between the terminal pressure taps are the orifice meter at the Kettleman Hills Compressor Station, a check-valve, one 20-inch and one 16-inch venturi cock, four 45° elbows, and 566 expansion or flexible joints. Fig. 2 shows the details of the joints and some of the fittings.

Frank Wills

The resistance of each of the above inserts, in terms of the velocity head in a 26-inch (25.25-inch I.D.) pipe, was obtained by calculation from manufacturer's specifications for pressure drop,

Line

By FRANK WILLS
Engineer of Production
*Pacific Gas and Electric Company**

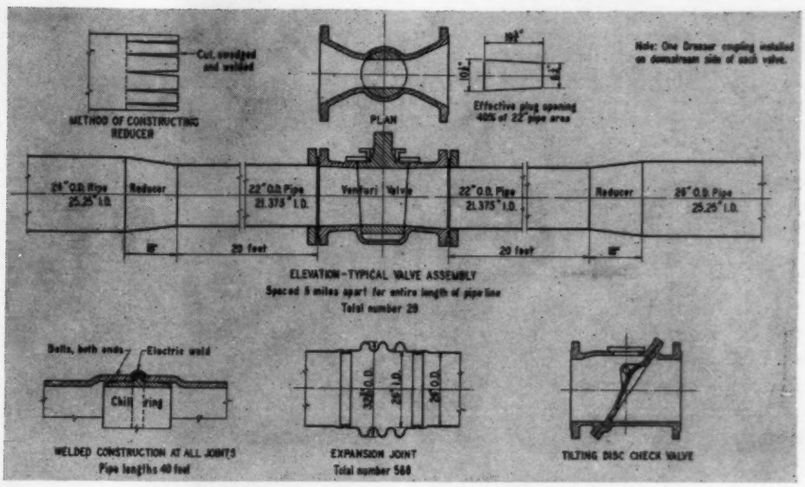


FIG. 2. Details of fittings and joints on the Stanpac line.

the application of published data, or by test. The resistances of the lubricated venturi valves, the check valve, and the orifice meter were calculated from manufacturer's data. Resistances for the converging and diverging swedge pieces were estimated from information given by W. H. Carrier on pages 67 and 70 of "Fan Engineering," published by the Buffalo Forge Co., 1925, while those for 90° elbows were taken directly from "New Data for the Design of Elbows in Duct Systems," by Loring Wirt, General Electric Review, for June, 1927.

In order to obtain some idea as to the resistance of the expansion or flexible joint, a model was constructed and tested. This model was geometrically similar with respect to corrugations versus diameter but included 21 waves or wrinkles instead of 3, with approach and discharge pieces 10 diameters in length. The pressure drop in velocity heads was compared with that for a very smooth tube of the same overall length and a second smooth tube of a length equal to the sum of the lengths of the approach and discharge pieces of the first tube. Thus, friction factors for the wavy section of the first tube and for an equal length of smooth tubing were obtained. The rate of flow corresponded with a Reynolds number of $d\,u\,s/z$=3,000,000. The friction factor for the wavy surface was 0.0306 and for the smooth pipe 0.0026. From these data the loss through the expansion joint was taken to be 0.10 velocity heads, the equivalent length in 26-inch pipe for a 26-inch joint being 14 feet. Values for all sizes are shown in Table No. 2.

The resistance of any one of these fittings or special shapes is rather small,

* Mr. Wills' paper was presented upon the program of the American Society of Mechanical Engineers' Aeronautic and Hydraulic Divisions, held June 19-21 at the University of California and at Stanford University. It also represents an important part of the Pacific Coast Gas Association's Natural Gas Transmission Committee report to the annual convention at Del Monte, October 9-12, 1934.

TABLE NO. 2. RESISTANCE TO FLOW OF FITTINGS EXPRESSED AS EQUIVALENT LENGTH OF 25.250-IN. PIPE (26-INCH O.D.)
(Based upon a friction factor, f = .00334)

Fitting or Shape	Nom. dia. in direction of flow (in.) In.-Out.	Actual length of shape or fitting (ft.)	Actual lesser dia. (in.) D	$\frac{V^2}{2g}$ Resistance Referred to Lesser Diam. F_D	$\frac{V^2}{2g}$ Resistance Referred to 25.25 Diam. $F_{25\text{-}25}$	Net equiv. length in lesser dia. pipe (ft.) L'_D	Net equiv. length in 25.250" pipe (ft.) $L'_{25\text{-}250\ ins.}$
Lubricated	22 x 22	3.60	21.375	1.75	3.41	229.7	528.4
Venturi	20 x 20	3.35	19.4375	1.75	5.00	208.8	772.5
Valve	16 x 16	2.90	15.50	1.75	12.36	166.3	1907.7
Check Valve	22 x 22	3.00	21.375	0.581	1.13	74.5	171.3
Converging	24 x 22	1.5	21.375	0.04	0.078	3.83	8.8
Swedge	26 x 20	1.5	19.4375	0.04	0.114	3.35	12.4
	26 x 22	1.5	21.375	0.04	0.078	3.83	8.8
Diverging	16 x 20	1.5	15.50	0.336	2.380	31.0	355.4
Swedge	20 x 22	1.5	19.4375	0.336	0.960	39.2	145.2
	22 x 24	1.5	21.375	0.336	0.653	43.3	99.6
	22 x 26	1.5	21.375	0.336	0.653	43.3	99.6
Elbow	16 x 16	5.17	15.50	0.375	2.650	67.3	386.3
45°	22 x 22	7.13	21.375	0.375	0.730	92.9	106.8
Expansion	22 x 22	1.33	21.375	0.100	.195	12.0	27.6
Joint	24 x 24	1.66	23.3125	0.100	.137	12.9	19.2
	26 x 26	1.66	25.25	0.100	.100	14.0	14.0
Kettleman	20-inch tube		19.301	11.51	33.27	1369	5245
Meter	11.5-inch orifice	16.90	tube	tube			

and might well be neglected, but the total resistance of the entire group amounts to about 3.5 per cent of the total for the line.

While it is not probable that the final friction factors are within this degree of accuracy, it was considered desirable to account for all unusual resistances that might be conveniently estimated, if only to ascertain their importance.

There are other minor resistances which have not been accounted for such as those encountered in slight deflections (up to 12 degrees) at the expansion joints, and those imposed by the chill ring construction. The pipe line traverses some rolling terrain but, on the whole, it may be considered to be comparatively level; moreover, the chill ring construction, which is quite common, should offer a very slight resistance. Consequently, these characteristics may be regarded as occurring in any well located and properly constructed natural gas transmission line.

The fact that the line under study is tapped, and delivers gas to branches at 11 points enroute complicates the calculations somewhat. On this account, it has been necessary to express the resistances of all portions of the line in terms of equivalent lengths of 26-inch pipe, and it has been necessary, further, to allocate these lengths to their proper location with reference to the taps. The last tap is only 35 feet from the terminal pressure gauge and, in all cases, 84 per cent or more of the gas is carried to this point.

Table No. 1 shows the equivalent length factors for the various sizes in terms of 26-inch pipe, conversions having been made on the basis of the 5th powers of the diameters. This assumes that the friction factor for each section of the line will be the same. This is not strictly true but as will be seen later, the Reynolds number, represented by the flow through the line as a whole, is high and in the region where the friction factor curve is nearly flat. Furthermore, since 65.6 per cent of this line is 26 inches in diameter, the error involved is small when considering the line as a whole in terms of 26-inch pipe.

Preliminary calculations were necessary for an approximate friction factor to be used for the conversion of the resistances of the fittings and other shapes to equivalent lengths of 26-inch pipe. For this purpose a friction factor of .00334 (the average of seven checks since Sept. 1, 1933) was chosen. As this factor is applied to less than 4 per cent of the line resistance, the accuracy of this figure is not important. Table No. 2 shows the velocity heads resistance ($F_{25.25}$) for each of the fittings and their corresponding net equivalent length ($L'_{25.25}$) in feet. Since the number of velocity heads resistance of a pipe line may be expressed as $(48fL'/D)$ in which (L') represents length in feet and (D) the diameter in inches, the equivalent length in feet for each fitting may be obtained by equating this expression to the values tabulated under $F_{25.25}$ and solving for $L'_{25.25}$ as follows:

$$L'_{25.25} = F_{25.25}\, D/48f =$$

$$(25.25)(F_{25.25})/(48)(.00334) \qquad (1)$$

As the lengths of the sections of the line include the lengths occupied by the fittings, the net equivalent lengths for the resistances of the fittings, which are to be added to the distance between taps, are the lengths obtained from equation (1) minus the lengths of the fittings. In the case of elbows, the loss is based upon conditions permitting partial restoration of energy so that the net length is the length obtained from equation (1) minus 4 diameters ($4 \times 25.25/12$ ft.).

Table No. 3 presents the actual distances, sizes, fittings, and equivalent lengths for each section between the taps from which deliveries are taken and for the total line.

TABLE NO. 3. PHYSICAL DATA OF STANPAC PIPE LINE WITH CONVERSION TO EQUIVALENT LENGTHS OF 26-INCH O. D. PIPE.

STATIONS & TAPS	O.D.Pipe in Sec. (in.)	Actual Length (ft.)	Eq.lgt. 26" O.D. (ft.)	Valves, Orifices			Reducers			Ex.joints, Elbows			Eq.lgt.26" O.D. pipe b'tw'n taps (ft.)
				No.	Type	Eq.lgt. 26"O.D.ft.	No.	Type	Eq.lgt. 26" O.D.ft.	No.	Type	Eq.lgt. 26" O.D.ft.	
			(A)			(B)			(C)			(D)	(A + B + C + D)
Orifice Plate at P.G.& E.Comp. Sta.	24	8,837	13,172	1	0	5,245							
	22	79,140	182,046	3	22"V	1,585	1	22 x 24	100	8	22" E	221	202,801
	20	21	78	1	22"C	171	1	20 x 22	145	2	24" E	38	Miles 38.41
Coalinga	24	22,003	32,798				1	24 x 22	9				33,546
	22	40	92	1	22"V	528	1	22 x 24	100	1	24" E	19	Miles 6.35
Mendota	24	49,538	73,841				2	24 x 22	18				75,319
	22	80	184	2	22"V	1,057	2	22 x 24	200	1	24" E	19	Miles 14.26
West. Gulf Oil	26	30,243	30,243							2	22" L	214	
	24	50,552	75,353				3	26 x 22	27	3	26" E	42	218,667
	22	47,657	109,625	5	22"V	2,642	3	22 x 26	300	8	22" E	221	Miles 41.41
Miller	26	73,932	73,932				3	26 x 22	27				75,620
	22	96	221	2	22"V	1,057	2	22 x 26	200	13	26" E	183	Miles 14.32
Dos Palos	26	58,173	58,173				2	26 x 22	18				60,850
	22	104	239	3	22"V	1,585	3	22 x 26	300	38	26" E	535	Miles 11.53
Los Banos	26	130,507	130,507				5	26 x 22	45				136,731
	22	176	405	4	22"V	2,114	4	22 x 26	400	232	26" E	3,260	Miles 25.90
Newman	26	57,018	57,018				2	26 x 22	18				61,277
	22	73	168	2	22"V	1,057	2	22 x 26	200	200	26" E	2,816	Miles 11.61
Patterson	26	73,341	73,341				2	26 x 22	18				76,062
	22	111	255	3	22"V	1,585	3	22 x 26	300	40	26" E	563	Miles 14.41
Vernalis	26	26,732	26,732				1	26 x 22	9				27,602
	22	40	92	1	22"V	528	1	22 x 26	100	10	26" E	141	Miles 5.23
Tracy Town	26	44,047	44,047				1	26 x 22	9				
	22	40	92	1	22"V	528	1	22 x 26	100				45,738
	20	10	37	1	20"V	772	1	26 x 20	12	10	26" E	141	Miles 8.66
Milpitas,Holly S.	20	21	78										3,274
	16	14	161	1	16"V	1,908	1	16 x 20	355	2	16" L	772	Miles .62
Orifice Plate at Tracy Terminal													
Total, feet		752,546	982,930			22,362			3,010			9,185	1,017,487
Total, miles		142.53	186.16			4.24			0.57			1.74	192.71

(O) indicates orifice meter (E) indicates expansion joint
(V) " lubricated venturi valve (L) " 45 degree elbow
(C) " check valve

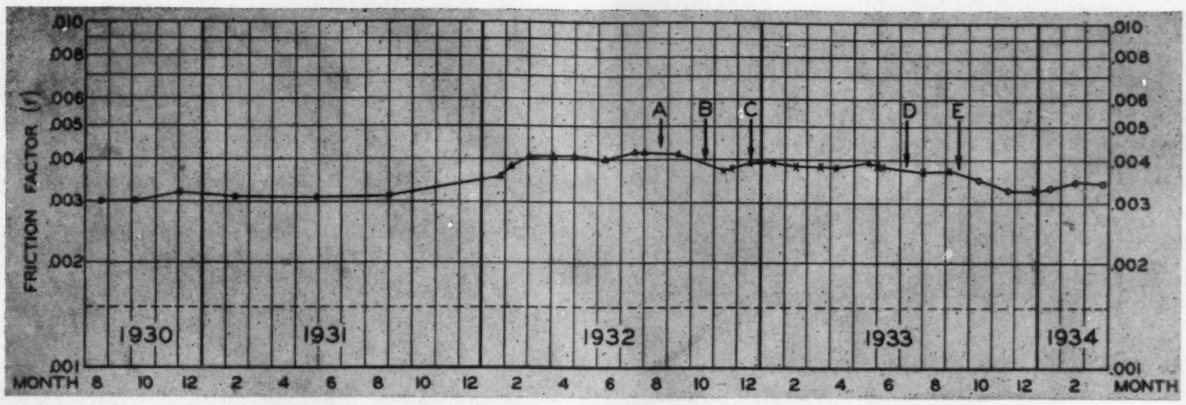


FIG. 3. History of the friction factor of the Stanpac natural gas line.

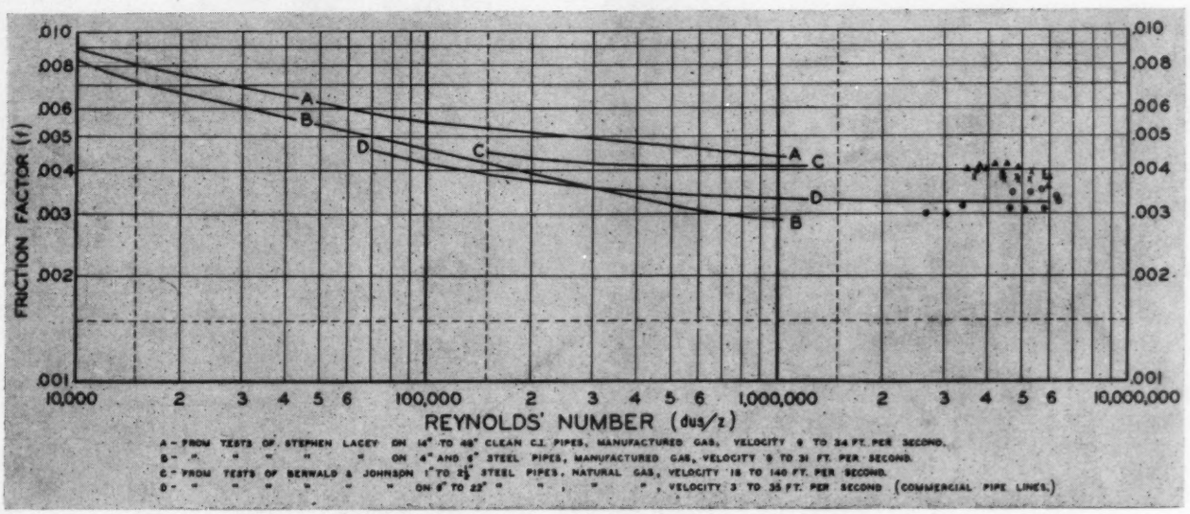

FRICTION FACTOR (f)
.010
.008
.006
.005
.004
.003
.002
.001
A
B
C
D
10,000 2 3 4 5 6 100,000 2 3 4 5 6 1,000,000 2 3 4 5 6 10,000,000
REYNOLDS' NUMBER (dus/z)
A - FROM TESTS OF STEPHEN LACEY ON 14" TO 48" CLEAN C.I. PIPES, MANUFACTURED GAS, VELOCITY 9 TO 34 FT. PER SECOND.
B - " " " " " ON 4" AND 6" STEEL PIPES, MANUFACTURED GAS, VELOCITY 6 TO 31 FT. PER SECOND.
C - FROM TESTS OF BERWALD & JOHNSON 1" TO 2½" STEEL PIPES, NATURAL GAS, VELOCITY 18 TO 140 FT. PER SECOND.
D - " " " " " " ON 6" TO 22" " " , " " , VELOCITY 3 TO 35 FT. PER SECOND (COMMERCIAL PIPE LINES.)

FIG. 4. Friction factor of Stanpac natural gas line versus Reynolds' Number.

The following was the basic equation used for pipe line flow:

$$Q = 60\sqrt{\frac{D^5(P_1^2 - P_t^2)}{f\,L\,S}}\sqrt{\frac{519.6}{T}}\sqrt{Y} \qquad (2)$$

or

$$Q^2L = \frac{(3600)(519.6)\,D^5\,Y}{f\,S\,T}(P_1^2 - P_t^2) \qquad (3)$$

In which

Q=cu. ft. of gas at 60° F. and 30 inches of mercury, transported per 24 hours.
D=Internal diameter of pipe, inches
P_1=Initial absolute pressure, lbs. per sq. in.
P_t=Terminal absolute pressure, lbs per sq. in.
f =Friction factor
L =Length of line, miles, (including allowance for the fittings listed in Tables No. 2 and No. 3)
S =Specific gravity of gas at 60° F. and 30 inches Hg. (air=1)
T=Temperature of gas, °F., abs.
Y =Factor for deviation of gas from Boyle's Law.

Equation (3) is derived, using the following constants:

Acceleration of gravity=32.174 ft. per sec. per sec.

Density of air, at 60°F. and 30 inches mercury, dry,=.07654 lbs. per cu. ft.

Density of mercury=13.595 grams per cu. cm.

30 inches of mercury=14.735 lbs. per sq. in.

The friction factor (f) is such that the total friction in velocity heads is expressed by 4 f L/d (L and d being expressed in common units).

In a transmission line delivering gas to taps enroute as well as at the terminus, the flow is in series with decreasing amounts of gas moving in each successive section. The lengths and the resistance of fittings between the taps may differ but must be expressed in terms of the equivalent lengths of a common diameter, in this case 25.25 inches. By writing an expression for the flow in each section in the form of equation (3) and adding, an overall or "straight through" equation is obtained:

$$Q_1^2L_1 + Q_2^2L_2 + \text{---} + Q_t^2L_t = Q_e^2L = \frac{(3600)(519.6)D^5Y}{f\,S\,T}(P_1^2 - P_t^2) \qquad (4)$$

Q_1 =cu. ft. per day flowing in the 1st section
Q_2 =cu. ft. per day flowing in the 2nd section
Q_t =cu. ft. per day flowing in the terminal section
L_1 =equivalent length, miles in 1st section
L_2 =equivalent length, miles in 2nd section
L_t =equivalent length, miles in terminal section
L =equivalent length, miles in total line
Q_e =cu. ft. per day that could flow "straight through" the line from end to end with the existing initial and terminal pressure. It is the "straight through equivalent" of the actual deliveries.

Therefore, the friction factor, as determined, was obtained by using the following equation:

(Continued on Page 60)

41st CONVENTION for COAST

Convention Dates Changed to October 9-10-11-12

WE ARE stopping the press as this issue of *Western Gas* is being printed, to record a sudden change in dates for the Pacific Coast Gas Association Convention. Due to unforeseen circumstances the Association finds it necessary to shift its four-day meeting to October 9, 10, 11 and 12. Original dates were September 11-14.—EDITOR.

THOSE who know from past experience of the benefits and pleasures which go along with attendance at an annual convention of the Pacific Coast Gas Association—and this includes virtually every member in Association territory as well as a host of friends from elsewhere in the industry—are turning their eyes to Del Monte. October 9, 10, 11 and 12 are marked off on the gas man's calendar for the 41st Annual P.C.G.A. Convention. President George P. Egleston and Managing Director Clifford Johnstone have had their heads together for weeks setting up convention details, and the complete program appearing below speaks volumes for the results of their labor, and that of the Association's efficient committee organizations.

Each year P.C.G.A. committees put together a body of research and original data which ranks at the forefront of contributions to gas literature. This year will be a counterpart to those which have gone before in this respect, and in addition a number of general session addresses are in store on topics which at the moment are challenging the industry's consideration.

Del Monte is recognized far and wide as an ideal convention spot and has been the scene of many smooth-running P.C.G.A. conventions. T. W. Snell, division manager for the Pacific Gas and Electric Co. at Salinas, Calif., is this year's general chairman of the Convention Committee. W. S. Crabbe is Hotel and Program Manager. Entertainment is in the charge of A. C. Miller. P. S. George is chairman of the Registration and Banquet Committee, and will be assisted by G. A. Peers and A. M. Reisen. E. J. Hinchey of James Graham Manufacturing Co. is handling men's golf arrangements. Reception and attendance is the responsibility of a committee headed by Don C. Ray, chairman, with W. M. Henderson, C. H. Potter, A. F. Rice and K. C. Tomlinson assisting.

A complete schedule of interesting activities for the convention ladies is detailed as a part of the following program. Arrangements for the ladies are in the capable hands of Mrs. George P. Egleston, hostess.

A number of special exhibits on advertising, women's committee work, and remote control equipment will be on inspection at the convention, further details being given in the following pages.

President Egleston will call the 41st Convention to order at 10:30 A.M., Tuesday, October 9. The complete program, arranged under the heads of general sessions and sectional meetings, is presented in the following columns.

GENERAL CHAIRMEN

W. J. McCOY
Accounting

PIERRE VINET
Commercial

D. BUCKLER
Advertising

GENERAL SESSIONS

TUESDAY . . 10:30 A.M.

Address of Welcome—A. F. Hockenbeamer, President, Pacific Gas and Electric Co.

President's Address—George P. Egleston, President, Pacific Coast Gas Association.

Report of Board of Directors—Clifford Johnstone, Managing Director, Pacific Coast Gas Association.

Election of Officers.

Amendment of By-Laws.

The World's Largest Buyer—Geo. W. Bean, Fuel Consultant, American Gas Association.

TUESDAY . . 2:00 P.M.

Customer Relations Conference Under Auspices of Public Relations Section

Opening Remarks—R. E. Fisher, Chairman, Public Relations Section.

Public Relations Reflects Employee Education—H. M. Thomas, General Manager, Northwest Cities Gas Co.

Symposium on Employee Education and Training—E. G. McCann, Manager Personnel Department, Pacific Gas and Electric Co., Chairman.

1. Conference Method of Employee Training.
2. Public Relations Audits.
3. Collection Policies.

WEDNESDAY . . 9:30 A.M.

Load Building Conference

Where Does Gas Stand in Air Conditioning?—J. W. Wrenn, Pacific Gas and Electric Co.

Employee Education Builds Public Good Will and Added Load—H. L. Farrar, President, Coast Counties Gas and Electric Co.

Mass Distribution Requires Multiple Outlets—R. E. Fisher, Vice-President, Pacific Gas and Electric Co.

INDUSTRY...Here's the Program

OF P. C. G. A. SECTIONS

EL ROY PAYNE
Manufacturers

R. E. FISHER
Public Relations

F. A. HOUGH
Technical

The Chicago Gas Appliance Society Program—A. E. Higgins, Field Representative, American Gas Association. (Illustrated with a Motion Picture.)

The Potential Market for Gas—H. M. Crawford, General Sales Manager, Pacific Gas and Electric Co.

WEDNESDAY . . 8:00 P.M.

General Program Under Auspices of The Public Relations Section

Two Public Speaking Contests (one for men and one for women); subject: "The Importance of Load Building to the Company, to the Employee and to the Consumer."

Kitchen Planning—An Illustrated Lecture—Doris Allen, Los Angeles Gas and Electric Corp. (An Illustrated Lecture prepared as a part of the program of the Women's Committee.)

THURSDAY . . 9:30 A.M.

The New California Tax Structure—M. D. Lack, Manager, Tax Department, Pacific Gas and Electric Co.

Inducement Rates as an Aid to Load Building—Paul M. Downing, Vice-President and General Manager, Pacific Gas and Electric Co.

Good Will Through Advertising—L. E. Townsend, Assistant Advertising Manager, Bank of America.

The Political Horizon—Dr. W. W. Cumberland, Economist, Wellington & Co., New York.

ACCOUNTING SECTION

W. J. McCoy, *General Chairman*

General Auditor, Southern Counties Gas Company

WEDNESDAY . . 2:00 P. M.

Advantages of Direct Posting to Control Ledgers—A. B. Cates, Jr., Assistant Auditor, Southern California Gas Co.

Charts and Graphs for Presentation of Accounting Statistics—Frank V. Doucette, Statistician, Southern Counties Gas Co.

THURSDAY . . 2:00 P. M.

The Revenue Act of 1934 as It Affects Gas Companies—William A. Lewis, Tax Accountant, Southern Counties Gas Co.

Discussion: Accounting Problems Created by New Taxation Measures.

Conference of Executive Committee.

COMMERCIAL SECTION

Pierre Vinet, *General Chairman*

District Manager, Coast Counties Gas and Electric Company

Tuesday, 8:00 p.m. Utilization Conference (See Technical Section).

Wednesday, 9:30 a.m. Load Building Conference (See General Session).

WEDNESDAY . . 2:00 P.M.

INDUSTRIAL SALES COMMITTEE REPORTS

F. H. Woodward, Chairman, Pacific Gas and Electric Company.

1. Industrial and Commercial Heating Applications—R. L. Grutzmacher, Chairman, Natural Gas Equipment, Inc.
2. Gas on the Farm—H. E. Davidson, Chairman, Southern California Gas Co.
3. Gas in the Hotel and Restaurant Field—R. J. Phillips, Chairman, San Diego Consolidated Gas and Electric Co.
4. Who is a Logical Gas Engine Prospect?—Chas. Remschel, Power Engineer, Southern Counties Gas Co.
5. The Training of Industrial Salesmen—E. M. DeRemer, Chairman, Southern California Gas Co.

THURSDAY . . 2:00 P. M.

Joint Meeting with Publicity and Advertising Section

DOMESTIC SALES COMMITTEE REPORTS

Frank Moon, Chairman, Los Angeles Gas and Electric Corp.

1. Domestic Water Heating—A. F. Rice, Chairman, H. R. Basford Co.
2. Gas Refrigeration—J. E. Kern, Chairman, Southern California Gas Co.
3. Auxiliary Space Heaters—John Redd, Chairman, Los Angeles Gas and Electric Corp.
4. Gas Ranges—J. Earl Jones, Chairman, Seattle Gas Co.
5. Kitchen Planning—Jessica Taylor, Chairman, Los Angeles Gas and Electric Corp.

How Gas Companies Can Successfully Use Direct Mail Advertising.—Chas. W. Collier, Recorder Printing and Publishing Co., Western Governor, Direct Mail Advertising Association.

PUBLIC RELATIONS SECTION

R. E. Fisher, *General Chairman*

Vice-President, Pacific Gas and Electric Company

Tuesday, 2:00 p.m. Customer Relations Conference (See General Session).

Wednesday, 8:00 p.m. Public Speaking Contests (See General Session).

THURSDAY . . 9:30 A. M.

WOMEN'S COMMITTEE

CLYDA E. WEEMS, Chairman, San Joaquin Light & Power Corp.

This meeting will take the form of an informal discussion conference which will include the following topics:

1. The Expanding Field of Home Service—Its Opportunity for Utility Women. Led by Gladys Price, Southern California Gas Co.
2. Women's Contribution to Load Building Programs.
3. What Can the Women's Committee do for the Small Group?
4. The Educational Value of Acquaintance with Company Properties and Policies.
5. The Present Economic Condition a Challenge to Utility Women.

12:15 P.M. Women's Committee Luncheon. Reports of Company Committee Chairmen and General Committees.

PUBLICITY AND ADVERTISING

DOUGLAS BUCKLER, *General Chairman*

Superintendent of Advertising and Publications, Southern California Gas Company

WEDNESDAY . . 2:00 P.M.

Experience with Cooking Schools—W. D. Thurber, Advertising Manager, Southern Counties Gas Co.

What Salesmen Prefer in Advertising—A. C. Joy, Manager, Publicity and Advertising Department, Pacific Gas and Electric Co.

Utility Advertising in Southern California—J. S. Spaulding, Advertising Manager, Los Angeles Gas and Electric Corp.

THURSDAY, 2:00 P.M.—Joint Meeting with Commercial Section (See Commercial Section).

TECHNICAL SECTION

F. A. HOUGH, *General Chairman*

Distribution Engineer, Southern Counties Gas Company

TUESDAY . . 8:00 P.M.

Utilization Conference

Air Entrainment in Free and Enclosed Jets—Frank Wills and M. A. Richford, Pacific Gas and Electric Co.

Pilot Light Design—Guy Corfield, Chairman, Los Angeles Gas and Electric Corp.

The A.G.A. Laboratory Program on the Pacific Coast—F. E. Vandaveer, Supervisor, Los Angeles Testing Laboratory, American Gas Association.

Appliance Installation Standards—A plan for future investigation by the Utilization Committee.

Sampling of Flue Gases—J. M. North and N. K. Senatoroff, Los Angeles Gas and Electric Corp.

Symposium on Utilization.

WEDNESDAY . . 2:00 P.M.

PRODUCTION COMMITTEE REPORT

Butane-Air Mixtures for Stand-by Supply for Natural Gas Systems —J. A. Harritt, San Diego Consolidated Gas & Electric Co.

NATURAL GAS TRANSMISSION COMMITTEE REPORTS

P. E. BECKMAN, Chairman, Pacific Gas and Electric Co.

1. Pipe Protection—Wm. R. Schneider, Chairman, Pacific Gas and Electric Co.
2. Compressor Stations—A. B. Newby, Chairman, Southern California Gas Co.
3. Internal Corrosion and Dehydration—A. B. Allyne, Chairman, Southern Counties Gas Co.
4. Large Volume Measurements—R. M. Stewart, Chairman, Pacific Gas and Electric Co.
5. The Friction Factor for the Stanpac Transmission Line—Frank Wills, Engineer of Production, Pacific Gas and Electric Co.
6. Facilities for Remote Control of Pressures—H. V. Linkins, Pacific Telephone and Telegraph Co.

The meeting will adjourn to witness a live demonstration of Remote Control Equipment.

THURSDAY . . 2:00 P.M.

DISTRIBUTION COMMITTEE REPORTS

A. R. BAILEY, Chairman, Coast Counties Gas and Electric Co.

1. Effect of Temperature on Meter Proof—W. A. Bahr, Chairman, Pacific Gas and Electric Co.
2. Effect of Humidity on Meter Proof—Harold M. Crawford, Chairman, Los Angeles Gas and Electric Corp.
3. Curb Meters—F. H. Winslow, Chairman, Southern Counties Gas Co.
4. Cast Iron Service Connections—H. S. Harris, Chairman, Los Angeles Gas and Electric Corp.
5. Ventilation of Regulator Vaults—H. S. Harris, Assistant Engineer, Los Angeles Gas and Electric Corp.
6. Distribution Pressure Control—Eltinge Henderson, Chairman, Southern California Gas Co.
7. Major Interruptions to Service—W. M. Henderson, Chairman, Los Angeles Gas and Electric Corp.

EXHIBITS

ADVERTISING

The Publicity and Advertising Section has prepared a comprehensive Exhibit of current gas company advertising. It will be set up in the downstairs corridor near the Auditorium.

WOMEN'S COMMITTEE

The Women's Committee presents a series of exhibits in scrapbook form. Each scrapbook details the activities and accomplishments of a Company Women's Committee. In the Main Lobby.

REMOTE CONTROL EQUIPMENT

A number of manufacturers of remote control equipment will conduct an exhibit in the billiard room downstairs. Through the cooperation of the Pacific Telephone and Telegraph Co. the equipment will be connected with the Meter Station of the Pacific Gas and Electric Co. at Hollister. The equipment can be viewed at any time during the Convention but an official demonstration will be made immediately following the adjournment of the Technical Section Meeting on Wednesday afternoon.

LADIES' PROGRAM

Wednesday

10:00 A.M. Putting Contest and 18-hole Golf Tournament, Hotel Del Monte Course.

Thursday

Luncheon and Bridge at Del Monte Lodge, Pebble Beach. Cars will leave the Main Hotel Entrance promptly at noon.

7:00 P.M. Annual Banquet and Dinner Dance.

NEW TYPE MODERN GAS RANGES
TESTED AND APPROVED
This Seal...
ON THE GAS RANGE WILL HELP RENT THE APARTMENT!
A vigorous consumer advertising campaign, plus an intensive merchandising drive on the part of nearly 200 dealers in Chicago and vicinity (including the Loop department stores and large furniture houses), is impressing the women of Chicago with the many advantages of modern gas ranges which have been "Tested and Approved" by the Gas Appliance Society of Metropolitan Chicago.
Alert apartment house owners and management companies can capitalize on this merchandising effort by equipping vacant apartments with new, modern gas ranges which bear the "Tested and Approved" seal.
Most used of all household appliances, the gas range exerts a powerful influence on women in renting apartments. Give your apartments this outstanding advantage. Install modern, fully equipped "Tested and Approved" gas ranges. Write or telephone for full information, prices, and details of an appealing time-payment plan.
The following makes of ranges carry the "Tested and Approved" seal
A-B · ALCAZAR · DETROIT JEWEL · GARLAND · LAUREL
MAGIC CHEF · MOORE VANITY · ROPER · UNIVERSAL
GAS APPLIANCE SOCIETY OF METROPOLITAN CHICAGO
WARRANTY CERTIFICATE
MANUFACTURER'S STANDARD WARRANTY CERTIFICATE
approved by
Gas Appliance Society of Metropolitan Chicago
GUARANTEE
You know the GAS RANGE IS OF HIGHEST QUALITY if it bears this Seal!
GAS APPLIANCE SOCIETY OF METROPOLITAN CHICAGO

LEFT: Special advertising to apartment house owners. CENTER: Manufacturers and Appliance Society joint guarantee on gas ranges bearing the "double check" seal of the Society. Inset shows post card by which dealers advise Society of sales, and request inspection of installation. RIGHT: One of the consumer messages.

Cooperation Is Selling the Modern Gas Range in Chicago

By CRAIG ESPY

Eastern Manager, Western Gas

LATE 1933 saw the inception of an organization in Chicago which is rapidly changing the practice of this important market with respect to the purchase of gas ranges. The Gas Appliance Society of Metropolitan Chicago, composed of utilities, dealers and manufacturers of gas ranges, went into action with its carefully formulated program in February of this year and has much to show for the efforts made to date.

For four or five years prior to the Society's organization there had existed a condition of cut-price competition. Prices had been forced down to a point where neither dealer nor manufacturer could afford to advertise new developments in gas ranges. It followed, logically enough, that housewives of the Chicago area knew little or nothing about the modern gas ranges.

There are approximately a million ranges in use in the Metropolitan district. A survey showed that 85 per cent of these were obsolete; that is to say, they were without modern improvements, oven controls, etc. This state of affairs left the market vulnerable to any sort of aggressive sales effort which might be made. The Society's campaign thus took on the air of a defensive as well as offensive cooperative action, building a wall of protection against entrance of ranges using competing fuels.

Low-price ranges had made up the bulk of the market for a considerable period of time. And as housewives bought new ranges, they usually replaced what they had with like merchandise. This trend is being changed rapidly today through the coordinated efforts of dealers, utilities and manufacturers belonging to the Appliance Society.

Already the condition has reversed itself with respect to new ranges sold, by many dealer members of the Society, with approximately six out of seven ranges now sold bearing the "double check" seal of the organization—which seal means "tested and approved" modern gas ranges with self-lighting, oven heat control and insulated ovens. An expenditure of between $65,000 and $75,000 in well-directed radio, newspaper, and show window advertising is making the public conscious of the latest features of the gas range.

In completely coordinating sales and advertising effort, the Society has sponsored a sales school from which 280 representatives of dealer organizations have already been graduated. The course consists of three lessons covering the importance of the range in the home, the market possibilities, fundamentals of good salesmanship, correct range display, psychology of selling women, and the basic appeals in selling gas ranges.

Three talking pictures are an important part of the course of instruction. One of these is entitled "The Heart of the Home and Glorified Cooking with the Modern Range." This picture is also available for showing before church organizations and societies and has been viewed by thousands of women in the district.

Another film demonstrates the actual sale of a gas range and illustrates how additional prospects are secured from the sale. A third film analyzes a sales demonstration, discussing each step in the sale.

Advertising, in addition to being directed to housewives, also calls for the attention of apartment owners and rent-

(Continued on Page 34)

DISTRIBUTION

Field Testing of Large Capacity Positive Meters

● B. PORTER, United Gas Public Service Co., Houston, Texas, addressing 1934 Southwestern Gas Measurement Short Course, Norman, Oklahoma.—(Abstract):

THE generally accepted methods for testing large capacity positive meters are:

1. The critical flow prover.
2. The low pressure flow prover.
3. The diaphragm type test meter.

1. The critical flow prover must be operated at a pressure of at least 15 pounds gauge and is, therefore, adaptable to the testing of meters operating at a pressure equal to or greater than 15 pounds gauge.

The apparatus usually consists of a piece of 2-inch pipe 12 inches long with orifice flange at one end and ⅜-inch tap located about 4 inches from the flange, a thermometer usually ranging from minus 20° to plus 120° F. inserted in cylindrical case with ⅜-inch connection, a stop watch, and a set of five calibrated orifices ranging in capacity from 250 feet to 6,000 feet per hour, index rating. Upon each orifice must be stamped the correct time for the passage of 1 cubic foot of air, index rating, at 60° F.

The prover is connected as close to the downstream side of the meter as possible. A 2-inch gate or stop cock is usually installed for this purpose. After the connection is made, it is necessary to run a leakage test. This may be done by placing a blind plate in the orifice flange, applying the pressure and using soapsuds on all connections. Meters should be tested when possible at their operating pressures, with at least three separate orifices or at three different rates. These are commonly known as the check, intermediate and open rate. The selection of these orifices should cover the range of the demand upon the meter. The pressure should remain fairly constant throughout each test and a sufficient interval should elapse for the meter to become thoroughly purged and the thermometer to indicate the true temperature before starting to check the time. The test time for each orifice should be not less than 100 seconds and should cover one or more revolutions of the proving hand.

To determine the correct time for the passage of any number of feet, multiply the number of feet passed by the standard air time of the orifice and this result by the factors for temperatures, specific gravity and ratio of specific heat.

The proof of a meter is the actual time in seconds as shown by the stop watch divided by the correct time as determined by the above method.

2. The low pressure flow prover is in reality a small orifice meter operated at a pressure of from 4 to 8 ounces. It is commonly used for testing meters whose operating pressure ranges from 4 ounces to 15 pounds.

The apparatus consists of two lengths of 2-inch or 4-inch aluminum pipe with special flange, a stop watch, a U gauge, a thermometer, an Aneroid barometer and a set of six orifices of various sizes. The standard time in seconds required for the passage of 1 cubic foot of air at unit conditions is stamped upon the outlet side of each orifice. Unit conditions are: Any upstream pressure, a downstream pressure of 8 diameters below the orifice of 29 inches mercury absolute, a differential across the orifice of 8 inches of water and a temperature of 60° F. The length of the pipe on the upstream side is from 8 to 12 diameters . It is equipped with straightening vanes and a pressure tap one diameter above the orifice. The length of pipe on the downstream side is 8 diameters.

The pressure is taken off the meter and the prover attached to the outlet or to a connection near the outlet. The U gauge is attached to the pressure tap one diameter upstream from the orifice. An orifice of desired capacity is placed in the flange. The pressure is then applied from a valve on the inlet side of the meter until it remains constant between 5 and 10 inches of water, as indicated on the U gauge. A leakage test is then made by applying soapsuds to all joints. It is important that there is no backflow through the downstream gate. This can be prevented by installing a blind plate in the flange on the upstream side of the outlet gate.

In order to arrive at the correct time in each test where the specific gravity is known, it is necessary to note the following conditions: The temperature at a point approximately 2 inches from the outlet of the prover, the barometer reading in inches of mercury, and the number of inches water pressure on the U gauge. The test time is then checked by means of a stop watch for not less than 100 seconds and for one or more complete revolutions of the proving hand.

The correct time is the number of feet passed multiplied by the orifice standard time and the result in turn multiplied by the factors for test pressure in inches of water, barometer pressure in inches of mercury, temperature and specific gravity.

The proof of the meter is the test time divided by the actual time as was described in Section 1.

3. The diaphragm type test meter is nothing more or less than a positive displacement meter of aluminum casting which is tested and adjusted in the meter shop and transported to or from the different locations.

This method of testing is especially applicable to field meters operating at a low pressure.

When the location of a meter renders it necessary for the inspector proving with gas to do his work inside a building, certain safety hazards develop which require additional equipment in order to carry the discharged gas to the outside of the building. The United Gas Public Service Co. has overcome this condition as follows:

In the critical flow method it was necessary to add to the equipment a 20-foot-section of 2-inch spiral suction hose with 2-inch brass connections, the end of which is connected to the outlet of the prover by means of a special flange adaptable to the half flange on the prover. The outlet of the hose is then carried out of the building and fastened on the leeward side of the building as near the roof as possible. The accuracy of the critical flow method is not affected by the installation of this extra equipment, provided the absolute upstream pressure is double or more than double absolute downstream pressure.

In addition to the 20-foot section of hose, the low pressure prover method requires the substitution of a section of aluminum pipe for the downstream side of the orifice at least 12 diameters in length, with meter flange on one side and hose connections on the other. A pressure tap must be made 8 diameters downstream from the orifice and a thermometer tap 12 diameters below the orifice. An extra U gauge is also required. In making the prover connection with this method, one side of the U gauge is attached to the upstream pressure tap and the other to the downstream pressure tap. One side of the extra U gauge is attached to the downstream pressure tap and the other open to the atmosphere. The thermometer is inserted in the thermometer tap by means of a rubber plug. In order to arrive at the absolute outlet pressure in

each test, it is necessary to read the U gauge connected to the downstream pressure tap, convert this downstream pressure to inches of mercury and add to the barometer reading. All other factors remain unchanged.

In the diaphragm type test meter method it is only necessary to attach the hose to the outlet side of the test meter and pass the gas out of the building.

The Service Pipe

• **JACOB D. VON MAUR, engineer of distribution, Consumer's Gas Co., Toronto, Canada; addressing Canadian Gas Association Convention, Montreal, June 4-5, 1934.—(Abstract):**

THE service pipe is the first physical contact which the customer has with the facilities of the gas company. Interruptions to the customer's service, caused by deposits of rust, naphthalene or frost, or from broken, leaking or trapped services, have caused the distribution man no end of trouble, and have not always been paid sufficient attention in the search for remedies. It is not so much the expense to the company caused by the service trouble although that is a very considerable item, but it is the effect on the customer that is of first importance.

Fig. 1 shows a service pipe installed in the recommended manner. In all connections to the main a swing joint should be used. If the tapped hole is large compared to the size of the main a reinforcing tapped split sleeve is advo-

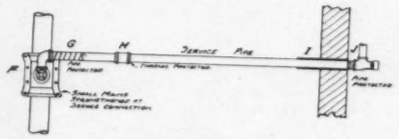


FIG. 1.

cated, as shown at F. Exposed threads are most likely to suffer corrosion, and therefore weaken the pipe; fittings with recessed threads, as shown at F and H, will remedy this. The service may corrode rapidly within a foot of the swing joint due to cuts in the pipe from the wrench during construction; a protective coating on the pipe for a distance of 12 to 18 inches, as shown in G, is suggested. Corrosion is very often experienced where the pipe goes through the cellar wall, and protection is applied accordingly, as shown at I.

Causes which made necessary the renewal of service and drip pipes in Toronto during the 10 years 1924 to 1934, were as follows:

Broken or damaged by outside parties	18.9%
Reported as "rusted out" (entire length)	37.1
Rusted out at cellar wall	17.0
Rusted out at coupling	7.0
Rusted out at drip or standpipe	11.7
Miscellaneous (no swing, etc.)	8.3
	100.0%

Fig. 2 gives diagram, and instructions for use, of apparatus used to remove deposits from services. This apparatus operates by suction, so that the deposits are not discharged into the main to subsequently appear elsewhere; at the same time the suction is not so great as to cause sudden low pressure in small mains and adjacent houses. By this means 250 pounds of rust and other deposits were removed from 900 services, in some instances before any stoppage had been reported by the consumer.

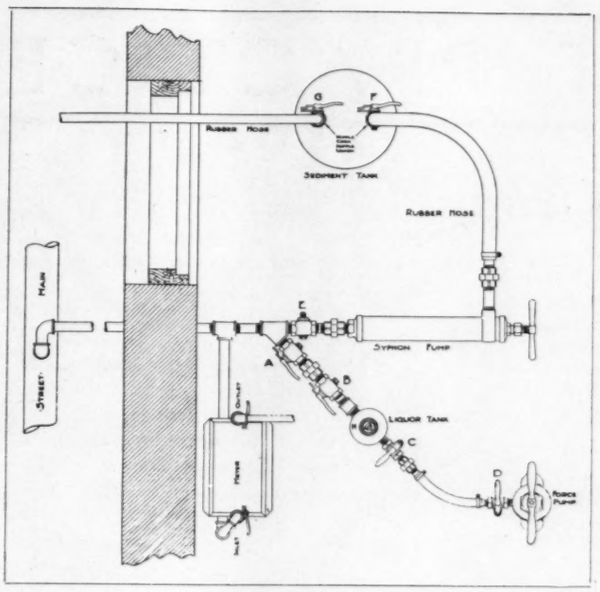


FIG. 2.

FIRST: Close meter inlet cock and disconnect meter at inlet.

SECOND: Attach Y fitting to service including cocks A and E. Next connect liquor container and force pump as shown. Fill liquor container with water, open cocks A and B. Depress check valve H and allow about one third of the water to flow into the service.

THIRD: Charge force pump with air to about 150 lbs. pressure. In the meantime, the water which was permitted to flow into service will have thoroughly saturated any scale or other foreign matter which may have accumulated in service pipe.

If this is sufficient in quantity, when balance of water and pressure from force pump is released into service at a very high velocity, a complete stoppage at street main connection invariably results.

FOURTH: If successful in creating a complete stoppage, valve C and D are then closed and the service is next filled with water which is introduced by filling liquor container until this purpose is accomplished. Valve A and B are then closed.

Valve E attached to syphon pump is then opened and syphon pump operated until a vacuum is created.

Valve F is then opened and if the suction created is sufficient the obstruction is discharged into sediment tank immediately release has taken place.

FIFTH: Open valve G to permit waste gases from sediment tank to discharge into atmosphere through hose placed outside nearest window.

If the above operations do not remove obstruction after first application they must be repeated.

SIXTH: Following the removal of obstruction, the liquor tank is again filled with water and this is forced through service at a very high velocity with aid of force pump which thoroughly washes walls of the service.

SEVENTH: After the day's service cleaning operations all drips on mains connected to the service must be pumped dry.

NOTE: Valves B and C are placed where shown to allow operator to disconnect liquor container at unions and fill same with gasoline at truck outside and carry into house without any danger of gasoline or fumes escaping, when equipment is being used for the purpose of dissolving napthalene in services.

Robert F. Daugherty Assumes New Post at Savannah Gas Co.

Robert F. Daugherty has been appointed assistant general manager and assistant treasurer of the Savannah (Ga.) Gas Co. Mr. Daugherty was formerly assistant general manager of the Jacksonville (Fla.) Gas Co.

Richard O. Berry, formerly assistant treasurer of the Savannah Gas Co., has been made manager of the new business department of the Jacksonville Gas Co.

Changes Announced in Southern Union Personnel

J. R. Cole, manager of the Albuquerque (N. Mex.) Natural Gas Co., has been appointed operating manager for the Southern Union Gas Co. of New Mexico, parent company of Albuquerque Natural. Cliff Castleberry, manager for Southern Union at Santa Fe, N. Mex., has been made assistant district sales manager for the company. J. C. Boyd, formerly in the Dallas, Texas, office of Southern Union, will succeed Mr. Castleberry at Santa Fe.

Leon O. Whitsell President California Railroad Commission

Leon O. Whitsell was elected president of the California Railroad Commission, August 1, succeeding Clyde L. Seavey, who has been made a member of the Federal Power Commission. Mr. Whitsell has been associated with the Railroad Commission for the past nine years.

Community Natural Managers Transferred

F. I. Collie, district manager of the Community Natural Gas Co. at Clarksville, Texas, has been made manager of the Commerce district, succeeding J. W. Inman, who has been transferred to Honey Grove; M. P. Nunnelly, district foreman at Honey Grove, succeeds Mr. Collie at Clarksville.

PLANT PRACTICE

Operation of Gas Holders

WATER-SEAL HOLDERS

● **HERBERT W. ALRICH, Consolidated Gas Co. of New York; addressing Canadian Gas Association Convention, Montreal, June 4-5, 1934; topic "The Servicing of Gas Holders."—(Abstract):**

CROWN sheets are liable to failure from both corrosion and loss of ductility. The former condition is shown in Fig. 1. The corner "A" of the underlapped plate will probably have been swedged cold and later punched, both of which operations stress the material far beyond the elastic limit and readily account for the corrosion often found at such points, as shown in Section A-A. Referring now to Section B-B, there is indicated a shallow grooving of the metal at A and B, caused not only by action of the caulking tool, but also as follows: The uniform elastic response of the crown of a holder to the internal pressure is prevented by the riveted seams which act as stiffeners. Hence, as the pressure on the crown varies during the inflation and deflation of the holder, a weaving action is developed in the plating at right angles to the seams. There may occur, then, appreciable grooving or even cracking of the metal. Corrosive destruction in this same form has also been discovered in the side plating of the sections of a holder.

When the metal in the thin courses of plating next to the heavy outer crown courses loses its ductility and is therefore unable to conform to the changing curvature of the crown, under varying holder pressures, cracking will occur. Referring to Fig. 2, the line C represents the curvature of the crown under the minimum pressure of the holder, while D indicates the stretch or expansion which occurs upon full inflation. It is obvious that, along a circumferential strip at E, the plating is subjected to a weaving action which eventually destroys the elastic property of the metal.

The holder cups at the water line should be frequently painted with Navy

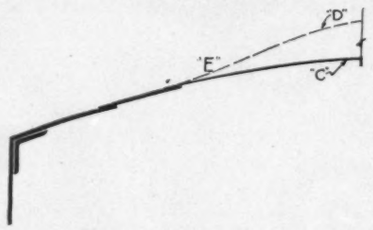


Fig. 2.

specification red lead, well rubbed on—with adequate drying time in between coats and after the last. Nothing is gained by adding an excessive amount of dryers to the paint, as the quality will be impaired.

It is not advisable to protect the steel of the tanks with an outside wall of concrete, even if the tank has been depressed in the ground. The concrete accelerates corrosion, and better protection will be had by a good paint application.

WATERLESS HOLDERS

● **H. C. OSLER, superintendent gas stations, Montreal Light, Heat & Power Co.; addressing Canadian Gas Association Convention, Montreal, June 4-5, 1934; topic "Operating and Checking a Waterless Gas Holder."—(Abstract):**

IN SEPTEMBER, 1931, was completed in Montreal a 10 million cubic foot M.A.N. holder. It is the most northerly holder on the continent, operating from temperatures of 95° above to 30° below Fahrenheit, a range of 125°.

The tar used as a seal for the piston cup is the most vital factor to be considered, and has to be constantly supervised to attain successful operation. Great care was exercised in selection of the original tar, and specifications were developed as follows:

Specific gravity about 1.10.

Viscosity, about 18 seconds at 100° F. Saybolt furol.

Acid, less than ½ of 1%.

Free Carbon, less than ½ of 1%.

First Drop, perferably about 230° C.

Residue, above 300° C. about 50%.

Residue should be a soft pitch at room temperature.

Distillation fractions should be free from objectionable crystals at 0C. and lower.

Tar itself should be fluid at –35° F.

Considering the time of the year holder was put to work, winter conditions had to be faced almost immediately, so that it was essential tar should be right. This tar has, up to now, given entire satisfaction, and apart from keeping its viscosity and cold test regulated for winter and summer operations, has functioned without trouble.

As regards tar to replenish the sealing system, experience has eliminated the seriousness of adhering rigidly to the original specification and the essential requirement is a tar low in carbon and naphthalene content and with a relatively low cold test, to mix with existing tar which has all the essential qualities of a good base.

Directly affecting the minimum and maximum levels of tar in the cup assuming a sufficiency of tar sealant, is the amount the piston itself is out of level due to obvious reasons which bring about this condition. It is essential that piston be kept on a horizontal plane, as far as it is possible to do so, and should not, in our size of holder, exceed a maximum range of 4 inches to 5 inches out of level. Measurements are taken

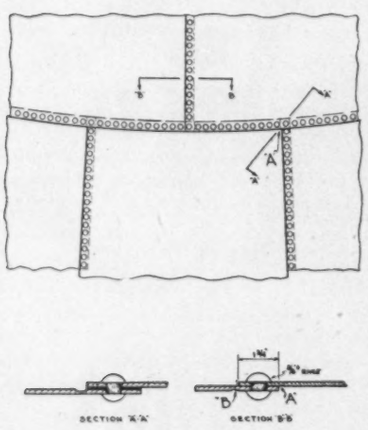


Fig. 1.

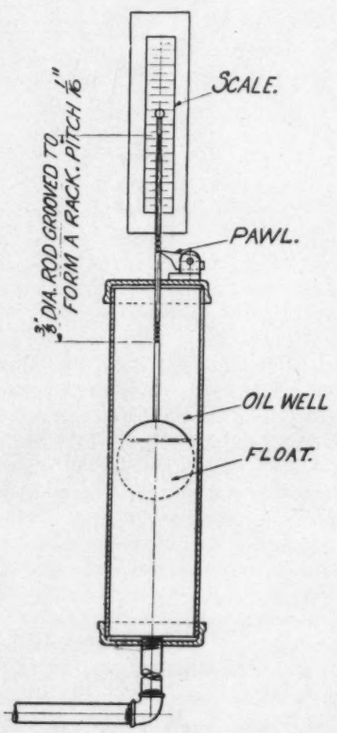


Fig. 3.

COMMITTEE:
DOUGLAS BUCKLER...SO. CALIF. GAS CO.
J. EARL JONES.....SEATTLE GAS CO.
A. C. JOY (CHAIRMAN).....P. G. & E.
D. L. SCOTT.....L. A. G. & E. CO.
PIERRE VINET.....C. C. G. & E. CO.

1934 P·C·G·A

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Western Hotel Reporter: Burner Regulation and Adjustment (first article of series on kitchen fuel efficiency) • Firing Periods (second article).

Pacific Coast Record: Firing Periods • White Log Taverns' gas equipment • Bernstein's Fish Grotto • Conversion Burners • Gas Company Service.

Keeler's Pacific Hotel Review: "El Cortez" (San Diego) Uses Gas Fuel • Gas Cooking at Seattle's "Oasis" • Natural Gas Serves Miramar Hotel.

Western Restaurant: Gas-fired Equipment in Lotus Cafe, Los Angeles • Firing Periods • Chef de Cuisine Ass'n. Entertained by Natural Gas Bureau • Southern Cooking at "Carolina Pines" • Gas Company Service • Conversion Burners • Broome Sells 100 Dozen Hamburgers Daily.

Pacific Coast Chef: Ranier Club Cooks With Gas • Aristocratic Hamburgers, Broome's Restaurant, Seattle • The Clark & Monson Restaurants.

Hotel News of the West: Local Business Venture Thrives (Clark & Monson restaurant chain).

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MISCELLANEOUS PUBLICATIONS

Western Plumbing and Heating Journal—Heating and Fresh Air Circulating Units • Exhibition of Gas-fired Unit Summer Air Conditioner at Third International Heating and Ventilating Exhibition, New York • Practical Cooperation, Address by R. E. Fischer, vice-president P.G.&E.

Western Baker—Correct Adjustment Assures Maximum Burner Efficiency.

Western Confectioner—Buddy Squirrel Shops Use Gas-fired Roasters.

Pacific Dairy Review—Steam Boiler Plant Efficiency Combustion Tests • Gas Company Service • Efficient Gas Burner Equipment.

Western Machinery & Steel World—Diffusion Combustion Heating Furnace for Copper Billets • A Cleaning Tank Using Natural Gas Fuel • Natural Gas in the Paper Industry.

Pacific Laundry Journal—Boiler Plant Efficiency; Burner Types • Automatic Control Equipment • Steam Boiler Plant at Santa Ana Laundry • Gas Company Service.

Architect & Engineer—Gas-fired Equipment, New Veterans' Administration Hospital, San Francisco.

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daily at the four cardinal points of the piston to secure this information.

To augment our means of checking these levels we fabricated and installed an automatic piston level indicator which indicates the maximum amount the piston is out of level in either direction during the day. It was constructed by installing five reservoirs fastened (See Fig. 3.)on the steel work of piston trusses and all set at exactly the same elevation. One is set at each cardinal point and the other is in the center, acting as a supply reservoir; all are connected by pipe lines. Those situated at quarter points are equipped with a copper float and shaft extended through a guide. These shafts have a series of circular grooves in them, and attached on the top of each reservoir is a dog catch which lies against the shaft, held in tension by a light spring. A scale graduated in inches and ⅛-inch for reading the actual movement which takes place is conveniently mounted behind the shafts. The system is filled to a determined level with a low freezing point oil, and any unevenness occurring is shown by the height of oil in the reservoir, and this in turn is reflected on the floats attached to the indicating shafts. As the shaft moves the dog catch allows the motion in one direction only. In this way the indicating shafts are held at the highest point the float rises to during the day. After the readings are checked with the manual measurements, the floats are set each day.

Evaluating Carburetting Oils by Hydrogen Content

• P. J. MERKUS, gas engineer, and A. H. White, chemical engineer, University of Michigan; addressing A. G. A. Joint Conference of Production and Chemical Committees, New York, May 21—(Abstract):

IT has only been since the introduction of the modern mechanically operated machines, that the water gas set has reached a position where it may be considered as a scientific instrument of considerable precision and so it has only been within the last few years that it has been feasible to attempt to correlate the chemical composition of the oil with its carburetting value as revealed in practice. It is also only within a relatively few years that gas oils of widely varying chemical compositions including cracked residuums and asphaltic base oils have been successfully used as gas oils.

The earlier investigators of the carburetting value of gas oils met with little

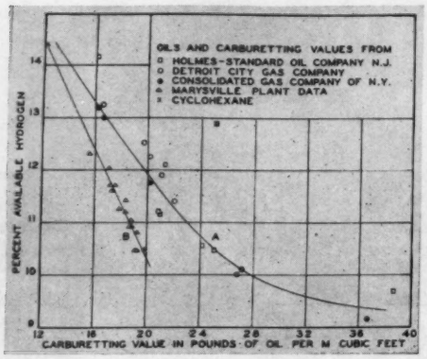
OILS AND CARBURETTING VALUES FROM
HOLMES-STANDARD OIL COMPANY N.J.
DETROIT CITY GAS COMPANY
CONSOLIDATED GAS COMPANY OF N.Y.
MARYSVILLE PLANT DATA
CYCLOHEXANE
PERCENT AVAILABLE HYDROGEN
CARBURETTING VALUE IN POUNDS OF OIL PER M CUBIC FEET

Fig. 1.

success in correlating chemical composition, specific gravity, distillation curves, and laboratory cracking tests with the results obtained in the plant, due in part to the uneven results of plant operation, and in part to the crudity of the laboratory cracking units. These latter have now been improved to the point where conditions are under close control and reproducible results are readily obtained.

Considering the pyrolysis of hydrocarbons, it is clear that the aromatic hydrocarbons are the most stable toward heat and that when they do decompose they give off hydrogen rather than hydrocarbons of low molecular weight; also that paraffines yield the largest proportion of fixed hydrocarbon gases. There seems, then, to be ground for belief that the hydrogen content of a gas oil should give an indication of its carburetting value. The small value of tars as a carburetting agent might also be explained by their low percentage of available hydrogen (4.9 to 8.4), available hydrogen being defined as the surplus hydrogen after all the oxygen in the compound has been calculated as in combination as water.

Thirty-five oils were examined, by ultimate analysis for hydrogen content, and by actual carburetting operation, the carburetting value being expressed as pounds of oil for 1000 cu. ft. of 530 B.t.u. gas. The relationships are shown in Fig. 1. The straight line B, on the chart, was developed from a producer using bituminous coal as fuel, rather than the normal coke, and therefore less oil usage would be expected.

TRANSMISSION

Preventing Corrosion of Bolts and Nuts

• J. A. PERRY, United Gas Improvement Co., Philadelphia, Pa.; addressing 1934 A. G. A. Distribution Conference; topic "Improvements to Mechanical Pipe Joints and the Prevention of Bolt and Nut Corrosion."—(Abstract):

A SERIES of tests were inaugurated to determine whether the bolts and nuts in the various mechanical pipe joints now in use are, or can be made, as resistant to corrosion as the cast iron pipe on which they may be used.

On the assumption that the corrosion would be electrolytic or galvanic, a uniform and controlled accelerated test was developed whereby the joints, properly made up, were immersed in a dilute solution of sulphuric acid (Specific gravity 1.004) and subjected to a constant electric discharge at a potential of 2.2 volts. After a suitable interval—approximately 1000 hours—the bolts were removed and weighed, and conclusions drawn from the relative losses in weight.

From the initial tests it appeared that the bolts would be subject to corrosion that would not insure a bolt life as long as pipe life. It therefore seemed advisable to protect the bolts in some manner, and it appeared logical to think that insulating them from the pipes, clamps or rings would materially add to their life. Tests indicated that insulation does retard corrosion, and also that protection, especially in cases where insulation was not possible, would also be of assistance. A variety of protective devices were tested. General conclusions from the whole series of tests are as follows (Patents are pending upon several of the devices mentioned):

1. Insulating the bolts should reduce electrolytic corrosion of the bolts and nuts.

2. Capping the nuts and heads of the bolts with an insulating material filled with a waterproof plastic should protect the nuts and heads from corrosion.

3. Shielding the heads and shanks of the bolts with metallic shields should satisfactorily protect these parts of the bolts from serious corrosion.

4. The exposed shanks of bolts between flanges should be satisfactorily protected against serious corrosion by the

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is non-corrodible, weather-proof, permanent . . . and Surprisingly Inexpensive

Heat in its most convenient form. That's what you're selling. To square your performance with your promise, you've got to provide appliances and equipment that are thoroughly dependable, virtually trouble-proof and maintenance-free.

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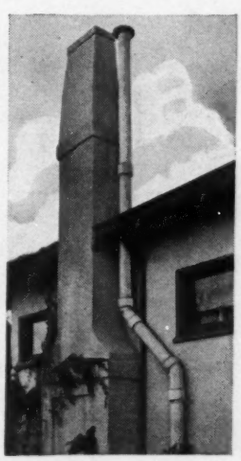
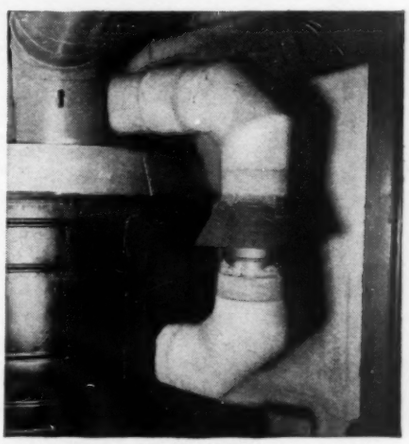


■ Absolutely weatherproof (it's made of asbestos fibre and Portland cement) J-M Transite Flue Pipe has solved the venting problem in thousands of Pacific Coast homes where flue pipe must be installed outdoors.



■ Rear view of gas-fired furnace vented by J-M Transite Flue Pipe. (Front view shown in photograph at top of page.) Transite Flue Pipe is quickly and easily installed; a full line of fittings is available.

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use of suitable waterproof compressible sleeves or grommets.

5. Shielding the nuts of bolts with metallic shields which form an integral part of the follower ring should greatly reduce the corrosion of the nuts and threaded ends of the bolts. Filling these recesses or inverted caps with a suitable waterproof plastic material should practically prevent corrosion of the nuts and thread ends of the bolts.

6. Shielding the heads and the nuts of the bolts with separately formed metal cup washers should greatly reduce the corrosion of the heads, nuts and threaded ends of the bolts. Filling these recesses or inverted caps with a suitable waterproof plastic material should practically prevent corrosion of these parts.

7. Suitable flexible waterproof caps forced or cemented on over the heads and nuts of the bolts should practically eliminate corrosion of these parts.

Viscosity of Liquids and Gases

• R. L. DAUGHERTY, Professor of Mechanical and Hydraulic Engineering, California Institute of Technology; addressing Summer Meeting, Aeronautic and Hydraulic Divisions, American Society of Mechanical Engineers, University of California and Stanford University, June 19-21, 1934; subject "Some Physical Properties of Water and Other Fluids"—(Abstract):

ONE of the important physical properties of all fluids is viscosity, but although much has been published on this subject the material as presented is tabulated in different units, shown in charts with different scales, and furthermore different classes such as gases and liquids have been shown separately, so that it is not apparent how they all compare one with the other. It is of interest to gather together data on fluids which differ widely and plot all on one single chart to the same scale so that the relation of one to another may be perceived at a glance.

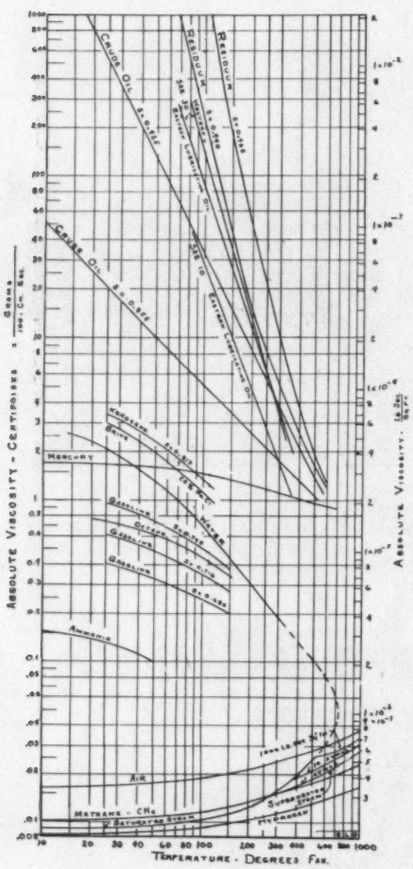

Fig. 1.

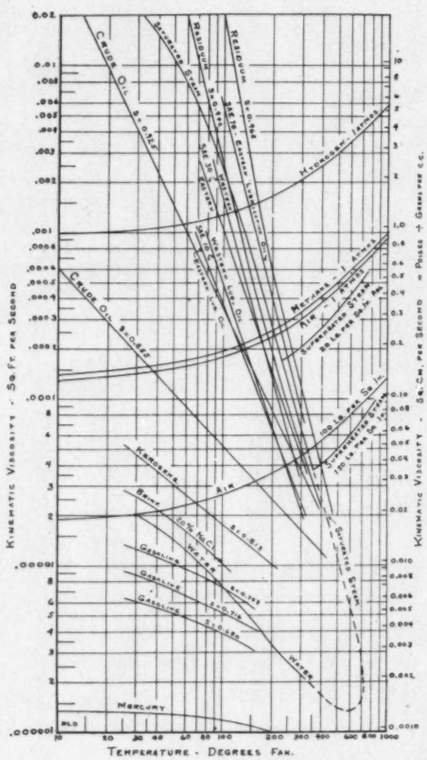

Fig. 2.

In Fig. 1 are shown the viscosities of such dissimilar fluids as mercury, hydrogen, air, fuel oil, ammonia and brine; furthermore, the viscosity curves for water and saturated steam have been joined at the critical temperature to illustrate the way in which the viscosities of all liquids and their vapors must coincide at the critical point.

Values of kinematic viscosity are shown in Fig. 2, kinematic viscosity being the ratio of viscosity to density; it is interesting to compare this figure with Fig. 1 and note, for instance, how hydrogen and mercury have changed places; also how, at 200° F., fuel oil (residuum) and natural gas approach each other and would therefore have the same friction factor for the same pipe size and velocity of flow.

UTILIZATION

Installing and Servicing House Heating

• F. J. GUNTHER, Assistant General Manager, Iowa-Nebraska Light and Power Co., Lincoln, Neb., addressing 1934 Annual Convention Mid-West Gas Association—(Abstract):

IN former years, when considering heat for the home, only wood and coal were available, and reasonably satisfactory utilization has been developed except for ashes, dirt, dust and poor regulation. Oil burning equipment, developed more recently, has been improved so that it is successful and economical. While oil equipment has the disadvantage of dirt, smoke and odor, it is nevertheless in use and well entrenched, and natural gas can only replace it by virtue of demonstrated superior qualities in convenience, cleanliness and comfort.

F. J. Gunther

Analysis of the potential house heating customers shows them divided into three buying classes.

There is the well-to-do class who want convenience as the first consideration because of circumstances or conditions. The cost of equipment or fuel is not of primary importance.

Another class considers cost on a par with convenience because 6 to 10 per cent of their income goes towards heating the home. Comfort and cleanliness are important factors. However, they lend a friendly ear to all competitive fuels.

With the rest the cost of heating is the primary consideration. They desire the advantages of good regulation, comfort, convenience and cleanliness if it is obtainable. Here again the heating bill

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What an Opportunity this tremendous market offers for building up new Year-round BASE LOAD . . .

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TABLE NO. I. SUMMARY OF HEATING SEASON HOUSE HEATING SERVICE CALLS IN LINCOLN DISTRICT

Items	Season 1932-1933 No. Service Calls	Season 1932-1933 % Of Total	Season 1933-1934 No. Service Calls	Season 1933-1934 % Of Total
A. Pilot Light				
1. Adjustment	672	25.7	854	31.6
B. Gas Supply				
2. Motor Valve	237	9.06	313	11.5
3. Furnace Governor	18	.8	15	.6
4. Meter	5	.01	5	.2
5. House Governor	17	.8	31	1.1
6. Governor Vent	21	.8	22	.9
7. Service Pressure	11	.4	13	.5
C. Control				
8. Thermostat	243	9.2	395	14.3
9. Electric Supply	98	3.7	101	3.7
10. Aquastats, Duplex Switches	104	4.0	54	2.0
D. Combustion				
11. Burner Adjustments	357	13.6	180	6.6
12. Draft Diverter	31	1.2	25	1.0
13. Vent	4	.01	....	....
14. Chimney	8	.3	8	.3
E. Miscellaneous				
15. Humidifier	197	7.5	181	6.7
16. Hot Air Dampers	13	.5	8	.3
17. Hot Air Runs	6	.02	2	....
18. Cold Air Leaks	2	.01	1	....
19. Gas Leaks	56	2.1	47	1.7
20. No Trouble	514	20.1	470	17.0
F. Total Calls	2614	100	2725	100
G. Turn-Ons and Turn-Offs (Calls)	1887	42	2272	
H. Grand Total	4501		4997	
Number House Heating Installations	1900		2300	
Average Calls Per Installation	2.37		2.17	
Cost Per Call	$1.13		$1.21	
Cost Per Installation	$2.68		$2.67	

Note: Excludes space heaters, circulators, etc.

represents about 6 to 10 per cent of the income. This class of cusomer represents about 50 per cent of the market.

Assuming that the job has now been sold, we find that in the physical operation of the equipment customers are also divided into three types.

There is the type who are exacting in their demands for service, usually requiring the utmost care and diplomacy in handling their complaints. In most cases this customer belongs to the first class of buyer referred to, is the first to take on natural gas, and since he purchased it purely because of its superior qualities, he is satisfied only with 100 per cent results.

Another type wants everything we have to offer in the way of service. They appreciate it and are even willing to pay for whatever is needed to make their heating plant operate efficiently.

With the rest practically no service is required except that termed as "emergency." This group is usually highly appreciative of everything done for them to help secure better results from their heating plants. The service calls from this group are far in the minority. They do a great deal in maintaining their heating systems in first class condition by keeping them clean, giving proper attention to oiling the moving parts, noting any changes in the functioning of the heating plant, and calling the company before the trouble develops. This particular group usually secures the best efficiency inherent in the fundamental design of the equipment installed. They represent about 50 per cent of the customers and are conservative and economical. Usually they are the last to avail themselves of natural gas for house heating.

With the coming of natural gas into a community the gas company is usually confronted with the most exacting requirements at the start. The first essential is proper man power. Operating executives should pay particular attention to obtaining proper men for installations and service at the start because success depends much on the work of these men. It is recommended that only men with previous experience and good operating records be utilized; their knowledge and ability will soon permeate the entire organization and tend to promote improvement in an old organization dealing in a new commodity. A pleasing personality, good approach, and mechanical ability represent the essential combination.

It is difficult to differentiate good installations from service because from a practical standpoint of view they go hand in hand; one of the first and most important steps to successful servicing of house heating equipment is the proper installation. Proper size burner or gas furnace for the particular job is very important. Our experience shows that in some cases too large equipment has been installed at the sacrifice of efficiency, causing high bill complaints. Adequate preliminary work should be done prior to the installation. This covers the proper size burners, fuel run, meter, regulator, piping, wiring, stack connection, condition of furnace, etc. These items should all be covered in the specifications supplied to the installation crew or service department by the engineering department. Close coordination of service and engineering departments is vital to secure good performance, proper appearance, etc.

There is also a great deal to be done in the way of instruction and education of the customer. The instructions finally adopted by our company first deal with starting the gas furnace. First of all the customer is ordered not to proceed with the instructions if there is smell of gas in the basement, and to call the gas company in this event. Second, the chimney base must be checked at the base for accumulation of old soot, bird nests, bricks and other foreign matter. The furnace smoke pipe rusts out readily and replacement is necessary if rusted through. The above precautions are all essential to the safe and efficient operation of the burner. With these out of the way the lighting of the pilot, closing of the switch, opening of the valves, etc., can proceed with entire safety. The remaining instructions are set up in simple form, under such headings as "To Start Furnace"; "To Relight Pilot"; "To Shut Down Furnace"; etc. Valves and switch are tagged and named with simple instructions on each to indicate the "on" and "off" positions.

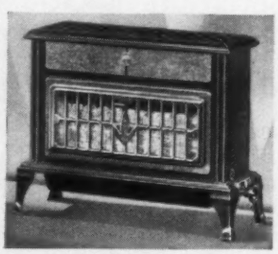
At present approximately 60 per cent of the customers turn their own furnaces on and off, the tendency being for the percentage to increase. It is deemed much better to follow the plan of properly instructing customers for several seasons, because unsafe practices are eliminated, the customer has service promptly when wanted, and it removes a great load from the service department—a load which it is almost impossible to handle satsfactorily when a good gas heating saturation has been obtained.

GENTLEMEN:

THE "SPIRIT OF PROGRESS" HEATROLA!

AGAIN, ESTATE disregards precedent and introduces a circulating gas heater that brings the future to today. A gas heater so modern in appearance, so efficient in operation, that it is bound to kindle a desire among untold thousands to heat their homes with gas.

No need to tell you how this new spectacular Gas Heatrola will revitalize your space heater business this Fall. No need to tell you the flair it will give to your advertising and merchandising. With the season just around the corner, you'll want the facts about the new Spirit of Progress, the In-A-Floor and other Estate Gas Heatrolas, right away. Write or wire for Catalogue No. 97. The Etate Stove Company, Hamilton, Ohio. Warehouse stocks in Los Angeles, San Francisco, Portland, Minneapolis, Dallas.



TWO MORE NEW MODELS

in the popular fireplace type.

No. 161 with an hourly B.T.U. input rating of 22,500. No. 171 with a rating of 35,000. Both housed in smart, new, two-tone cabinets.

GAS MERCHANDISERS CALL IT

THE SPACE HEATER HIT OF 1934

A check of a great many burners in operation one season by competent men indicated that a very thorough service inspection was desirable on all jobs after one year's service. Particularly evident was the need for scaling off old deposit in the fire bowl which dropped down and covered many of the burner ports. Some chimneys needed cleaning badly because of soot and foreign accumulations in the base. These conditions, of course, greatly impair the furnace efficiency. A standard policy of making a regular yearly inspection service of all jobs after the first season's operation has been adopted.

Service conditions encountered in the field, beyond those already mentioned are covered in Table No. 1 which shows a summary of service calls for the past two heat seasons.

Automatic Control for Gas House Heating

• A. C. GRANT, Minneapolis-Honeywell Regulator Co.; contribution to American Gas Association House Heating and Cooling Committee, C. A. Nash, chairman—(Abstract):

AUTOMATIC temperature control is one of the most important attributes of house heating with gas, for the reason that in most localities gas is more expensive, in "out of pocket" cost, than competing fuels, and the removal of automatic temperature and safety features robs the salesman of his most potent appeal.

The essential provisions of a fully automatic heating system are comfort, convenience, economy, health, safety, and modernization. Inasmuch as the monthly fuel bills are uppermost in the householder's mind when he contemplates purchase of, or replacement by, gas heating, the salesman and designing engineer must exercise skill and ingenuity in selling the less obvious but considerable economy of space saving, freedom from ash handling, avoidance of doctors' bills, etc., and installing the gas systems with proper automatic controls. The safety features are of great importance but should not be stressed to the customer unless he brings up the subject.

Considering the subject of temperature regulation, there is difference of opinion as to how close this regulation should be to provide comfort, but it is believed that a fluctuation of 1½° above or below the thermostat indicator setting can be tolerated, when the relative humidity is fairly constant and at an average percentage, and some air motion is provided. The mere fact that a thermostat can operate to this precision, however, does not mean that the room temperature will be maintained accordingly. Referring to Fig. 1, and assuming that the thermostat will shut off the burner at 70° and turn it on at 68°: As the temperature rises from turn-on at "a" there will be shut-off at "b", but due to heat head in the system the temperature will over-run to the extent of the upper shaded portion; similarly, on the downward path with turn-on at "c" the temperature will under-run, because of lag in the heating system and heat loss from the building, to the extent of the lower shaded portion; the areas of the shaded portions have been drawn very conservatively. It would seem obvious that to set the thermostat to call for heat and shut-off with a lesser variation would remedy this condition, but practically, in a great many instances, this results in burner operation too frequent and of too short duration, so that remote radiators or registers may not receive heat.

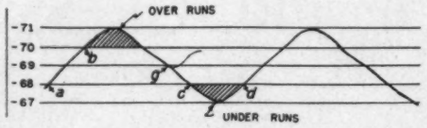


Fig. 1.

Several schemes have been devised to improve this type of control. The first was a system whereby the thermostat control was supplemented by a second thermostat called a low limit control, placed somewhere in or on the system so as to maintain a circulating temperature in the hot water or warm air system at all times, and call for heat frequently when the thermostat did not, to keep a few sections of steam radiators warm at all times. Automatic multi-stage control which provides means for two or more rates of gas combustion has been used successfully on some types of heating systems. In order to improve the room temperature regulation, extreme accuracy of thermostat adjustment is necessary. The cost of such a system is considerably in excess of the conventional system and is no doubt responsible for its rather limited use. The modulating control system is also expensive to install, imposes conditions of burner operation that make it somewhat unsatisfactory, and is not applicable to steam heating systems. Better temperature regulation has been obtained where the occupant has manually adjusted his limit control to a setting to correspond to the outside conditions or rates of heat loss. Among the more recent thermostatic devices can be mentioned one with a rotating cam auxiliary mechanism which periodically checks up on room temperature and when finding it below indicator setting turns on the burners before the temperature has dropped the full thermostat differential; another type, called the anticipating thermostat, works through a bi-metal element to shut off the burner considerably in advance of the time it would otherwise be extinguished. This prevents over-runs in temperature and lessens the operating differential materially.

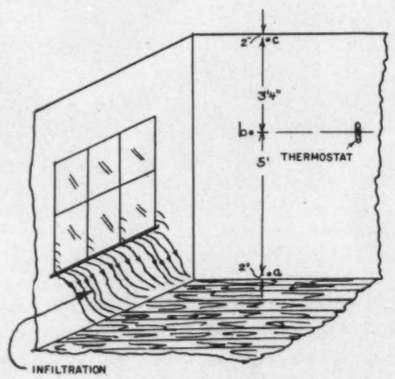
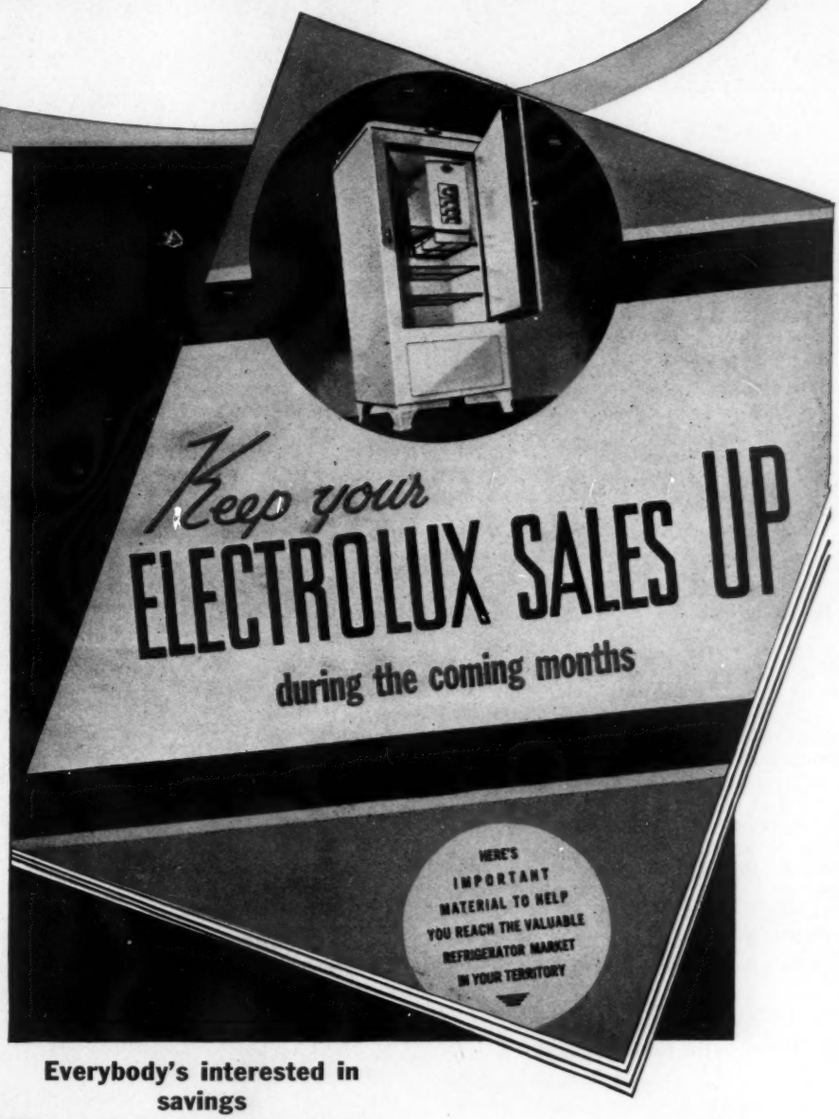


Fig. 2.

Uniform heat distribution with respect to different elevations in rooms is very important and, unfortunately, almost impossible of attainment. Considering Fig. 2, the temperature at position "a" will seldom if ever be the same as at position "b" if there is a temperature differential between inside and outside, even though heat is being delivered into the room, and the room air is in circulation. The ceiling temperatures, position "c", are seldom more than 3 or 4° higher than at position "b". These differential temperatures are controlled by outside temperature, solar radiation, wind velocity and direction, moisture of outside surfaces, insulation, infiltration, heating capacity and pick-up factor of system, and basement temperatures.

Thermostat location is very important with respect to these differential temperatures and heat distribution in general. A location too close to heat duct or pipe should be avoided. In some instances location near the baseboard has been successful, but here the thermostat is subject to tampering by young children and is inaccessible for reading and adjustment; an extreme cold weather differential between floor and breathing line would cause uncomfortably high temperatures and high fuel bill. No particular elevation for thermostat can be recommended because of wide variations in characteristics of building and heating systems, particularly if installations are made in the summer time so that these characteristics cannot be determined.

Keep your ELECTROLUX SALES UP during the FALL MONTHS


Keep your
ELECTROLUX SALES UP
during the coming months
HERE'S IMPORTANT MATERIAL TO HELP YOU REACH THE VALUABLE REFRIGERATOR MARKET IN YOUR TERRITORY

The National Housing Act is creating a definite modernization trend. Here's how you can take advantage of it.

A BILLION DOLLARS will be released this Fall for Home renovation. The Government through the National Housing Act is bending every effort to help thousands of homeowners to make improvements during the coming months. They'll be modernizing kitchens as well as other parts of the house. They'll be thinking in terms of the new up-to-date developments for comfort and convenience. And while they're in this frame of mind it's the psychological time to get their order for a modern Gas Refrigerator.

This summer's extreme heat has made more families than ever realize the need for modern refrigeration. And right now while they are receptive, you can bring to their attention the superiority and economy of gas refrigeration.

It will pay your company to maintain your sales efforts during the coming months. Use your local newspapers. Through consistent advertising in this medium you will gain quick and certain access to the prospects in your territory and tie in with the barrage of publicity now running on Home modernization.

Everybody's interested in savings

The arresting, convincing advertisements contained in the above folder drive home the unmatched 3-way saving that makes Electrolux pay for itself. Write to us if you haven't received your copy. Electrolux Refrigerator Sales, Inc., Evansville, Ind.

NEW *Air-Cooled*
ELECTROLUX
THE SERVEL *Gas* REFRIGERATOR

Cooperation Sells Modern Ranges in Chicago

(Continued from Page 21)

ers. Renters are directed through the copy to make sure that the apartment which they rent is equipped with a modern "double check" gas range.

A campaign of letters to the apartment owners points out that rental prices can be standardized where "double check" ranges are installed; that when so equipped, apartments rent more easily. The Society also utilizes the classified advertising columns in the local papers to advertise apartments equipped with ranges bearing its seal.

Apartment sale activities come under a special department of the Society dealing with wholesale activities. Manufacturers' representatives in the organization handle these sales.

Other important promotional work consists of decorative displays which are supplied to dealers at low cost. These range from small window and floor displays to complete exhibits of model kitchens. An advertising mat service is also supplied dealers as an aid in tie-in advertising.

A staff of 11 men is in daily touch with the dealer organization, giving sales help and advice as to displays and in general rendering a field secretary's service. Shoppers are also employed by the Society to determine whether salesmen are making profitable use of their sales training.

When a range is sold by a dealer member, he immediately dispatches a post card bearing the name and address of the purchaser to the office of the Appliance Society. The installation of the range is followed by a courtesy inspection from a representative of the Society who makes certain that the range is installed properly and is giving good service. He also provides the purchaser with recipe books and with a 90-day range guarantee signed by the Society and the range manufacturer.

A kitchen planning bureau is provided by the Society as a further service to the dealers in making sales.

No trade-in allowance is given in the sale of the new range.

A total of 231 dealers display the membership certificate of the Gas Appliance Society. These represent the most important department stores and furniture stores in the Metropolitan district. The Peoples Gas Light and Coke Co. and the North Shore Gas Co. are utility members. Firms making the A. B., Alcazar, Detroit Jewel, Garland, Laurel, Magic Chef, Moore Vanity, Roper and Universal ranges are manufacturer members of the Society.

Officers and directors of the Society are: Charles S. Maginnis, The Fair, president; James Parker, Wieboldt Co., vice-president; Charles A. Luther, The Peoples Gas Light and Coke Co., secretary. Managing directors are Theodore V. Purcell, The Peoples Gas Light and Coke Co. and John A. Fry, Detroit-Michigan Stove Co.

Next year's advertising appropriation is expected to be double that of the current year, which will give even greater impetus to the Chicago area's modern gas range activity.

Crude Naphthalene Proved Effective in Pest Control

Experiments conducted by the Bureau of Entomology, U. S. Department of Agriculture, at Walla Walla, Wash., have disclosed the effectiveness of crude naphthalene in controlling wireworms, a pest detrimental to garden crops. Eight hundred pounds of crude naphthalene is required per acre, the naphthalene being sprinkled in the furrows as the ground is plowed, and the field then disked to mix it with the soil. Soil temperature should be 70° F. for effective treatment.

Portland (Ore.) Gas & Coke Co.'s by-product was used in the tests.

Wis. Utilities Ass'n. Sections May Meet With Electric Ass'n.

Technical and Operation Sections of the gas and electric divisions of the Wisconsin Utilities Association may meet in joint session with the North Central Electric Association as a result of an invitation from R. M. Houger, president of the electric association. Meetings are tentatively planned for Madison, Wis., November 22-23, and programs which will schedule general sessions and separate sessions for technical and operating gas men are under preparation.

Arkansas Executive Quits R.F.C. Post To Resume Utility Duties

Harvey C. Couch, president of the Arkansas Power & Light Co., Pine Bluff, Ark., has announced his resignation as a member of the Reconstruction Finance Corp., effective Sept. 1. Mr. Couch was one of the original appointees by President Hoover to the relief agency. He is returning to his duties at Arkansas Power & Light Co.

Gas Service Co. Sales Up 49 Per Cent Over 1933

The Gas Service Co., Kansas City, Mo., reports an increase of 49 per cent in gas sales for the first six months of 1934, over the same period of 1933. Total gross sales reported for the combined new business departments of the company amounted to $341,455.

Pacific Pub. Service Co. Reports Gain

Pacific Public Service Co., San Francisco, Calif., and subsidiaries, excluding the California Consumers Co., now in receivership, reports a net profit of $259,726 for the six months ending June 30, 1934, as compared with the net profit of $52,729 for the same period of 1933. Operating expense was reduced from $1,364,081.78 to $1,043,508.23.

Revised Laboratory Publications Are Now Available

Reprintings in revised form of a number of standard A.G.A. Laboratory publications are now available, including the following:

"A Trip Through the A.G.A. Testing Laboratory."

"Sampling Products of Combustion from Gas Appliances"—F. E. Vandaveer.

"Safety from the Hazard of Fire with Gas Appliances"—F. E. Vandaveer.

"Radiant Heat from Radiant Heaters, and Its Measurement"—F. E. Vandaveer.

"Determination of Pressure Drop Through Gas Fittings and Controls on Gas Appliances"—J. Corsiglia and R. C. Gregg.

Copies may be secured by application to the American Gas Association Headquarters, 420 Lexington Avenue, New York, N. Y., the A.G.A. Testing Laboratory, 1032 East 62nd Street, Cleveland, Ohio, or the A.G.A. Testing Laboratory, Pacific Coast Branch, 718 Towne Avenue, Los Angeles, Calif.

Wisconsin Association Appoints A. G. A. Representatives

The following appointments have been made by G. V. Rork, president of the Wisconsin Utilities Association, to serve as delegates to the Managing Committees of the American Gas Association for the ensuing year: Accounting Section, John I. Allen, Wisconsin Gas & Electric Co.; Commercial Section, Howard W. Cooper, Wisconsin Power & Light Co.; Industrial Gas Section, A. A. Schuetz, Milwaukee Gas Light Co.; Manufacturers' Section, Mitchell Mackie, Fuller-Warren Co.; Technical Section, E. C. Brenner, Milwaukee Gas Light Co.

H. P. Rothwell Asks Permit To Serve Gillette, Wyo.

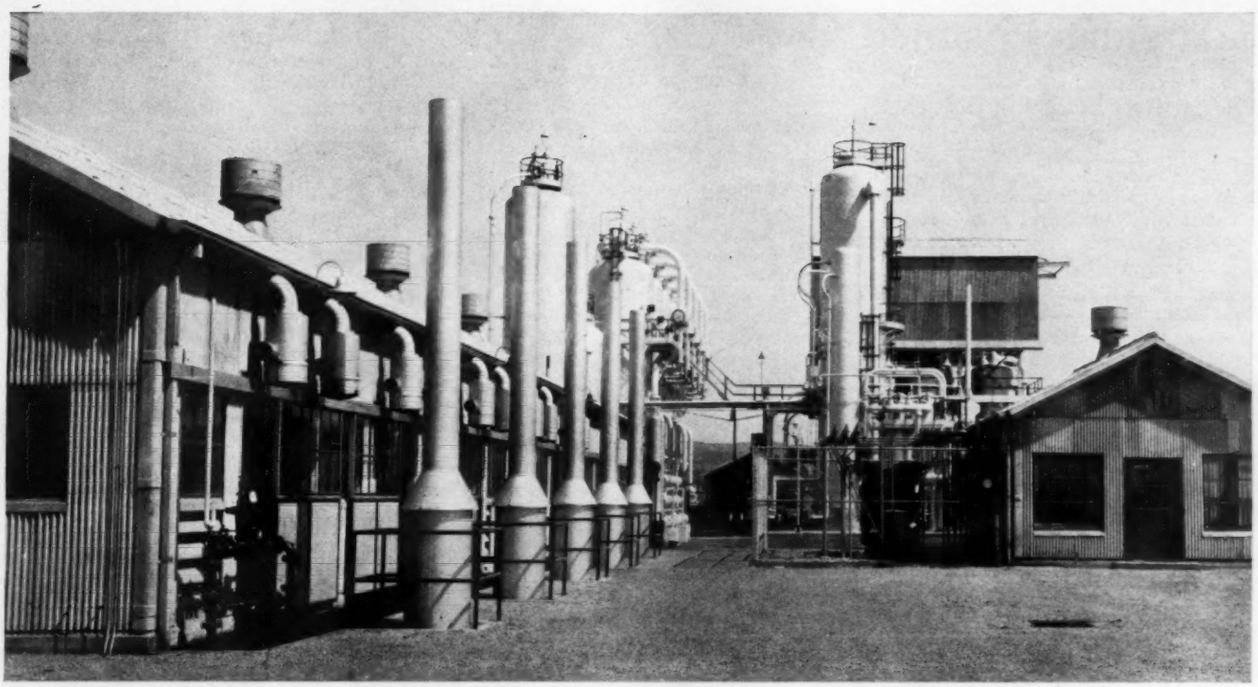
Henry P. Rothwell, Gillette, Wyo., has applied to the Wyoming Public Service Commission for a certificate of public convenience and necessity to construct and operate a natural gas distribution system in Gillette. A 25-mile pipe line would bring the supply from the Padlock Livestock Co. ranch, of which Mr. Rothwell is a principal owner, just north of the community. The gas wells have been brought in recently from shallow depths on the Padlock property.

Community Natural Gas Co. Improves Pilot Point Division Office

The Community Natural Gas Co., Dallas, Texas, has doubled the size of its Pilot Point division office, enlarging the gas appliance display room and offices. Redecorating plans will make the building conform to the general style of division offices over the system. W. O. Anderson is division manager at Pilot Point.

Uinta Pipe Line Co. Repair Work

Work of wrapping and relaying the Uinta Pipe Line Co.'s 18-inch natural gas pipe line from fields in southwestern Wyoming to Salt Lake City is scheduled to be completed September 1. Approximately $1,000,000 was expended in insulating the line with asbestos coating.



Fluor air-cooled mufflers
installed at the new dewaxing plant of the Union Oil Company, Oleum, Cal.

Every one of the ten features of Fluor air-cooled mufflers contributes materially to the economy of their application and operation. (1) No water is required. (2) No scaling or breaking of pipes. (3) No maintenance required. (4) No spray to corrode adjacent buildings. (5) Expansion couplings eliminated. (6) Consistently low back pressure. (7) Greater engine efficiency. (8) Cooler engine foundation. (9) Better engine room ventilation. (10) Quiet operation.

Savings in water alone are but a small part of the total savings gained by the installation of Fluor air-cooled mufflers, for maintenance charges where water-cooled mufflers are employed are unnecessarily excessive. For example, without water, no scale forms in exhaust lines; lines retain their full cross-sectional area eliminating the building up of back pressure on the engine. Chance of breakage is lessened for they remain clean. Elimination of water spray from mufflers reduces corrosion and costly maintenance on nearby equipment.

In construction the exhaust pipe of the Fluor air-cooled muffler automatically permits of expansion with changes in temperature. No coupling is required. The constant flow of air through the muffler, around the engine base, keeps it cooler and renders failure of concrete unlikely.

In addition to manufacturing special equipment, the Fluor Corporation offers a complete designing, engineering and structural service for the petroleum and gas industries.

Be Sure *with Fluor*

FLUOR CORPORATION
• LTD •
909 EAST 59TH ST. ● LOS ANGELES, CALIF.

Alton, Ill.
2342 State Street

Houston, Texas
1406 Esperson Bldg.

New York, N. Y.
220 E. 42nd Street

Tulsa, Okla.
Philtower Bldg.

Chicago, Ill.
McCormick Bldg.

Cleveland, Ohio
Terminal Tower Bldg.

Washington, D. C.
Barr Bldg.

Candidates Named for A. G. A. Offices

RECOMMENDATIONS of the General Nominating Committee of the American Gas Association for 1934-1935 officers and directors, which will be submitted to the annual convention at Atlantic City in October, include the following list of nominees:

For President: P. S. Young, vice-president, Public Service Electric and Gas Co., Newark, N. J.

For Vice-President: L. B. Denning, president, Lone Star Gas Co., Dallas, Tex.

For Treasurer: William J. Welsh, president and general manager, New York and Richmond Gas Co., Staten Island, N. Y.

For Directors—Two-Year Terms:

Addison B. Day, president and general manager, Los Angeles Gas and Electric Corp., Los Angeles, Calif.

B. J. Denman, vice-president and general manager, The United Light and Power Co., Chicago, Ill.

Henry L. Doherty, president, H. L. Doherty & Co., New York, N. Y.

O. H. Fogg, vice-president, Consolidated Gas Co. of New York, New York, N. Y.

Arthur Hewitt, vice-president and general manager, Consumers Gas Co. of Toronto, Toronto, Ontario, Canada.

N. C. McGowen, president, United Gas Public Service Co., Houston, Texas.

Wm. T. Rasch, president, American Gas Products Corp., New York, N. Y.

Thos. E. Roach, vice-president and general manager, Washington Gas and Electric Co., Tacoma, Wash.

W. Frank Roberts, president, Standard Gas Equipment Corp., Baltimore, Md.

Section Officers

The following members have been nominated by Section Nominating Committees to serve as section officers for the next Association year:

Natural Gas Department: For chairman—John B. Tonkin, president, The Peoples Natural Gas Co., Pittsburgh, Pa.; for vice-chairman, William Moeller, Jr., vice-president, Southern California Gas Co., Los Angeles, Calif.

Accounting Section: For Chairman—A. S. Corson, general auditor, The United Gas Improvement Co., Philadelphia, Pa.; for vice-chairman, F. L. Griffith, vice-president, The Peoples Gas Light and Coke Co., Chicago, Ill.

Commercial Section: For chairman—F. M. Rosenkrans, new business manager, The Gas Service Co., Kansas City, Mo.; for vice-chairman, C. E. Bennett, president, Binghamton Gas Works, Binghamton, N. Y.

Industrial Gas Section: For chairman—J. F. Quinn, supervisor, Industrial gas sales, The Brooklyn Union Gas Co., Brooklyn, N. Y.; for vice-chairman, C. W. Gale, superintendent commercial and industrial gas departments, Public Service Co. of Colorado, Denver, Colo.

Manufacturers' Section: For chairman—John A. Fry, vice-president and secretary, Detroit-Michigan Stove Co., Detroit, Mich.; for vice-chairman, apparatus division, Merrill N. Davis, vice-president in charge of sales, S. R. Dresser Manufacturing Co., Bradford, Pa.; for vice-chairman, Appliance Division, J. Scott Fowler, president, Lovekin Water Heater Co., Philadelphia, Pa.

Technical Section: For chairman—C. A. Harrison, gas engineer, H. L. Doherty & Co., New York, N. Y.; for vice-chairman, F. A. Lydecker, general superintendent of gas distribution, Public Service Electric & Gas Co., Newark, N. J.

The Nominating Committee was composed of the following: W. B. Tuttle, chairman; William C. Bell, H. C. Blackwell, H. L. Dickerson, Donald McDonald, and James L. Stone.

Industry Shows Good Gain in 6-Month Totals

DOMESTIC customers served by manufactured and natural gas companies totalled 14,751,600, for the first six months of 1934, according to American Gas Association figures; an increase of 360,000 customers since December 1933. This gain is reflected in the fact that a total of 425,000 gas ranges were sold in the country during the first half of 1934, a gain of 42 per cent over the first six months of 1933. Approximately 70 per cent of sales consisted of relatively high priced ranges incorporating modern automatic features, such as oven-heat control, etc.

Revenues of manufactured and natural gas utilities aggregated $378,697,300 for the first six months of 1934, a 3.1 per cent increase over the corresponding period of 1933. Revenues from industrial and commercial users increased more than 15 per cent. Revenue from domestic customers was practically unchanged.

Manufactured gas industry revenues totalled $199,782,400 for the first six months, a gain of 1.7 per cent. Revenues from industrial and commercial uses gained 6.5 per cent; revenues from domestic uses were 1.4 per cent less than for the corresponding period of 1933.

A similar situation was reflected in the reports of the natural gas companies. Total revenues for the six months amounted to $178,914,900, a gain of 4.6 per cent over a year ago. Revenues from industrial uses aggregated $45,086,400, representing an increase of 28.7 per cent. Revenue from domestic users of natural gas registered a loss of 2.3 per cent.

Bowdoin Division First in Minnesota Northern Power Co. "Derby" Contest

BOWDOIN division of the Minnesota Northern Power Co., which headquarters in Minneapolis, came in first in the company's recent annual spring sales "Derby," and has been named winner of the Grand Sweepstakes prize. Sheridan and Missoula divisions came in second and third, respectively. All sales were judged on a per meter basis, the result of which amounted in dollar sales to $14.15 for the Bowdoin division, $11.68 for Sheridan, and $8.11 for Missoula.

Each division was represented by a horse, with division managers acting as "trainers" and salesmen as "jockeys." An interest-builder was added in the introduction of parimutuel betting, which enabled participating salesmen to back their favorite divisions to win, place or show in the prize money.

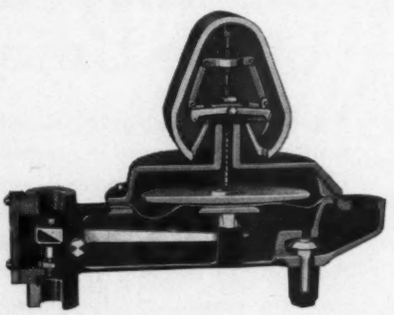
The campaign was set up and directed by A. E. Schwarz, commercial manager for Minnesota Northern.

For the company fall sales activity another "all-employee" campaign is in store, and it will revolve about the colorful theme of a gold rush, with $1,000 in cash available for prizes. A gold syndicate has been organized with company executives at the heads and division managers acting as mine bosses. Salesmen will do the digging, ranked as "snowbound," "tenderfeet," "prospectors," "diggers," "panners," "49'ers," or "old-timers," depending upon how many ounces of gold they are able to mine during the fall campaign in the form of appliance sales accomplishments.

Gold certificates will be issued to each mine boss for gold ore mined in his division, which certificates may be cashed in for prize money.

Mueller Co. Announces Development of New Evenflow Loader

The Mueller Co., Decatur, Ill., announces the development of a new product, the Evenflow loader, to enable the usual types of house service and low pressure regulators



to pass increased demand for gas without appreciable drop from set delivery pressure.

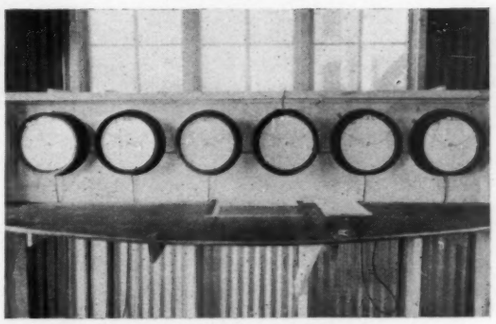
When the regulator diaphragm travels downward the loader exerts additional pressure to open the valve and maintain the set delivery pressure, up to the maximum capacity of the regulator. On individual services where the main pressure is 1 pound or more the manufacturers recommend a No. 1 service regulator equipped with the Evenflow loader, to deliver ample volume for house heating in addition to the ordinary domestic load. The Evenflow loader is available for most makes of spring type regulators, and will eventually be made for all types of house service or low pressure regulators. Complete information regarding the Evenflow device may be had by writing the Mueller Co., Decatur, Ill.

Keller Ass't Treas. at San Diego

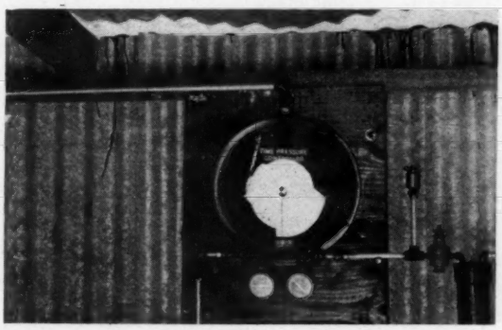
Gustav Keller has been appointed assistant treasurer of the San Diego (Calif.) Consolidated Gas and Electric Co. Mr. Keller has been with the company since 1910.

4 Gas Instruments that cut Distribution Losses

ANTI-AMBI RECORDING THERMOMETER. A unique, fully compensatcd Thermometer. It produces accurate records of true line temperatures. These records are used to make accurate corrections that result in the elimination of costly errors by temperature changes during measurement.



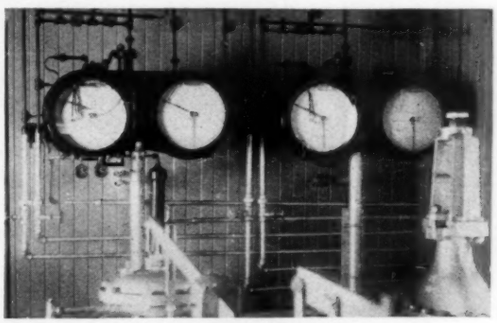
Anti-Ambi Recording Thermometers



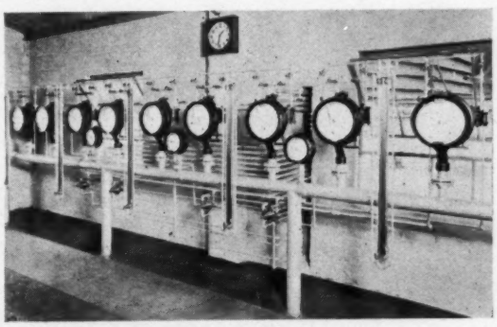
Time-Pressure Sensitizer

TIME-PRESSURE SENSITIZER. Losses from leakage are reduced to a minimum when the Time-Pressure Sensitizer is used. This instrument can vary the pressure to maintain the minimum for all varying load conditions. It can be equipped with aluminum cams that are easily cut and changed. This feature is a distinct advantage when schedules must be changed often during the year.

DIFFERENTIAL LIMIT CONTROLLER. The most economical method of measuring wide ranges of flow is with a Foxboro Differential Limit Controller. This instrument is a combination of Foxboro Orifice Meters and a gas-operated control system. Installations have been made with these instruments which have had a wide range capacity of 200 to 1.



Differential Limit Controllers



Orifice Flow Meters

ORIFICE TYPE FLOW METER. An economical instrument any way you look at it. Rugged—accurate—dependable—lowest in maintenance cost. This meter will stand the gaff of the roughest field service and give accurate readings under the most adverse conditions. Foxboro Meters should be specified wherever gas is valuable enough to require ACCURATE measurement.

Write for Information

FOXBORO
REG. U. S. PAT. OFF.
THE COMPASS OF INDUSTRY

THE FOXBORO COMPANY

FOXBORO, MASS., U. S. A.

Los Angeles, 2307 E. 8th St. San Francisco, 461 Market St.

BRANCH OFFICES IN PRINCIPAL CITIES

Most Complete Line of Instruments for Gas Distribution

Headliners on Natural Gas Department Program

PROGRAM arrangements for the Natural Gas Department sessions at the A.G.A. convention are now in practically final form, according to Capt. A. E. Higgins, secretary of the Department.

At 9:30 A.M., Monday, October 29, the Main Technical and Research Committee of the Department will meet at the Ambassador Hotel, Atlantic City, under the chairmanship of H. C. Cooper, Hope Natural Gas Co., Pittsburgh, Pa. This meeting will be an open session.

Making up the annual meeting program of the Department, two sessions will be held Monday, at 11:00 a.m. and 2:00 p.m., followed by a 6:30 p.m. annual meeting and dinner of the Executive, Managing and Advisory Committees.

Scheduled for the morning general session are the following addresses and reports:

Opening remarks and chairman's address—Frank L. Chase, chairman, Lone Star Gas Co., Dallas, Texas.

Report of Main Technical and Research Committee—H. C. Cooper, chairman, Hope Natural Gas Co., Pittsburgh, Pa.

Report of Nominating Committee and Election of Officers—George W. Ratcliffe, chairman, Manufacturers Light and Heat Co., Pittsburgh, Pa.

High Calorific Manufactured Gas for Peak Load as a Supplement of Natural Gas for Emergency Service—L. J. Willien, Byllesby Engineering and Management Corp., Chicago, Ill.

The afternoon sessions will offer the following features:

Compressor Station Problems—Burt R. Bay, Panhandle Eastern Pipe Line Co., Kansas City, Mo.

Natural Gas Fellowships—John B. Tonkin, Peoples Natural Gas Co., Pittsburgh, Pa.

Internal Corrosion of Pipe Lines—Elmer F. Schmidt, Lone Star Gas Co., Dallas, Texas.

Economics of Cathodic Pipe Protection—A. F. Bridge, Southern Counties Gas Co., Los Angeles, Calif.

Patrolling of Natural Gas Pipe Lines by Airplane—B. C. Comfort, Mississippi River Fuel Co., Saint Louis, Mo.

The Commercial End of the Gas Business—B. H. Gardner, Columbia Gas and Electric Corp., Columbus, Ohio.

GAS COMPANY OPERATIONS FOR THE STATES OF CALIFORNIA, ARIZONA, NEVADA, OREGON AND WASHINGTON AND THE PROVINCE OF BRITISH COLUMBIA

Six Months Ending June 30, 1934

Compared with Similar Period in 1933

THE Pacific Coast Gas Association in August released a statistical statement covering gas operations in the coast area for the first half of 1934 compared with the similar period of 1933. Effects of the abnormally warm winter are still to be seen on the domestic sales showing in the six-month report, though business the second quarter of 1934 improved over the second quarter of 1933.

A summary of gas operations for the states in the Association area for the 6-month period appears below:

	1933	1934	Per cent Change
Production—M c. f.			
Water Gas	1,212,524	1,148,331	
Coal Gas	402,222	236,111	
Oil Gas	2,423,496	1,758,035	
Coke Oven Gas	815,496	884,053	
Butane Gas—550 B.t.u.	132,567	112,144	
Natural Gas Purchased	75,576,203	78,104,267	
TOTAL	80,562,508	82,242,941	+ 2.1%
Active Meters—June 30			
Domestic	1,504,486	1,532,447	+ 1.9%
Commercial and Industrial	69,495	74,885	+ 7.8%
TOTAL	1,573,981	1,607,332	+ 2.1%
Sales—M c. f.			
Domestic	36,685,924	29,553,387	—19.4%
Commercial and Industrial	25,417,913	33,423,400	+31.5%
Steam-Electric Generation	7,290,064	9,038,778	+24.0%
TOTAL	69,393,901	72,015,565	+ 3.8%
Gross Revenue			
Domestic	33,130,427	27,962,883	—15.6%
Commercial and Industrial	7,479,197	8,397,102	+12.3%
Steam-Electric Generation	835,636	1,115,243	+33.4%
TOTAL	41,445,260	37,475,228	— 9.6%

Seattle Gas Co. Reorganizing Under Amended Bankruptcy Law

A PLAN for reorganization of Seattle Gas Co. is now in the course of preparation, gross earnings under the severe conditions of the past year having dropped to a point where interest payments on $1,299,000 of 6 per cent debentures falling due on August 1 could not be met. The company applied on August 2 to the Federal Court of its district requesting that the court take jurisdiction of its affairs under the Amended Bankruptcy Law, known as Section 77-B, adopted by the Congress on June 7 of this year.

Under the amended Bankruptcy Law the Court merely takes jurisdiction of the company's affairs without appointment of a trustee in bankruptcy or a receiver; the company is allowed to continue in possession of the property and to initiate a reorganization plan which the court may declare operative if approved by 65 per cent of each class of security holders.

The Seattle reorganization plan will be submitted to the court within 60 days from August 2. The court has assumed jurisdiction at the company's petition and temporarily enjoined creditors from bringing any action against the company. A hearing set for August 27 was to determine whether the court order would be made permanent pending circularization of the reorganization plan among stockholders and the securing of their consent to it.

Conditions in Seattle during the past year have drastically affected the gas company earnings, some 18,000 families or nearly 20 per cent of the population served, being on public relief during the year and more than 10,000 families receiving free fuel from the community.

Stripping Law Constitutional Says District Court

The Texas "sour gas law," permitting stripping of natural gas in the Panhandle area for natural gasoline content, regardless of market outlet for the gas, was upheld as constitutional last month by U. S. District Court Judge T. M. Kennerly, who also dismissed several suits attacking constitutionality of the law. The decision may result in the erection of additional gasoline plants in the Panhandle and even greater wastage than now exists, unless the Texas legislature produces a remedy for the situation. Judge Kennerly's decision held that the Railroad Commission was within its rights in granting stripping permits, under the Texas law.

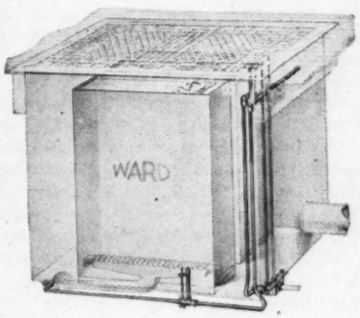
Jordan, Minn. to Have Natural Gas

The city council of Jordan, Minn., granted a general franchise July 16 to the Minnesota Valley Natural Gas Co., St. Peter, Minn., for the service of natural gas in Jordan.

BILT-IN Thermo-Control

—was adopted as standard equipment on Ward Floor Furnaces less than a year ago, and became an immediate success. The buying public, appreciating its simplicity, ease of manipulation, and economy, responded handsomely. As a result, 85% of the Ward Floor Furnaces sold have been equipped with the

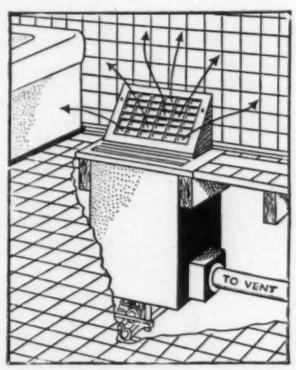
BILT-IN THERMO-CONTROL



Since then **Thermo - Control** has been improved. Gas friction has been reduced, a new indicator dial is used, and a few other little things have been touched up. Nothing important—no radical changes were necessary — but all in line with Ward's policy of constantly striving for perfection.

AND THE WALL-HE-TOR

—which is Ward's latest creation, now gives the gas industry entree to America's bathrooms with a **vented** appliance that is safe and occupies little space. And its operating cost is about one-fifth that of electricity. Wall-He-Tor also solves the problem of economical gas heat for small bedrooms, dens, and breakfast rooms.



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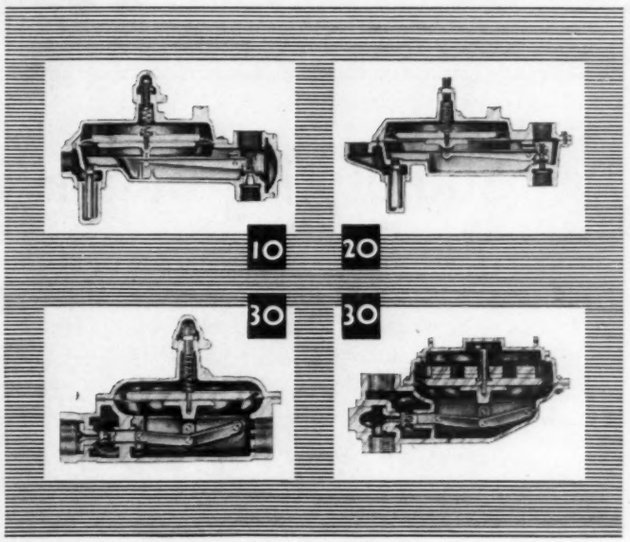

Illustrated, Cross-sectional views of: Models 10, 20 and 30. Model 30 is shown in spring and dead weight.

KNOW BEFORE HAND what type of Service Regulator will best meet the requirements of the installation, and operating efficiency will increase and upkeep cost will decrease.

REYNOLDS Service Regulators, Models 10, 20 and 30, are built to meet specific requirements —years of operation in the field, through a complete range of operation demands, have proved their superiority.

Write for complete details. Reynolds Engineering Department gladly co-operates in working out Gas Control Problems.

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MODEL 10—*Dead Weight or Spring Type,* with or without Mercury Seal, or Dead Weight Safety Seal. All working parts are so accessible as to be interchangeable without removal from pipe line.

MODEL 20—*Dead Weight or Spring Type,* with or without Mercury Seal, or Dead Weight Safety Seal. All working parts are so accurate as to permit complete interchangeability in shop.

MODEL 30—*For horizontal or vertical connections,* with or without removable valve pocket. Available with either Spring or Dead Weight adjustment. With or without Mercury or Dead Weight Safety Seal.

REYNOLDS GAS REGULATOR CO.
ANDERSON, INDIANA, U. S. A.

GAS CONTROL SINCE 1892

BUTANE • PROPANE NEWS

Vol. 4, No. 9 — September, 1934

Substituting Butane for Oil Gas at Needles

By D. E. York

Construction Engineer
Needles Gas and Electric Company

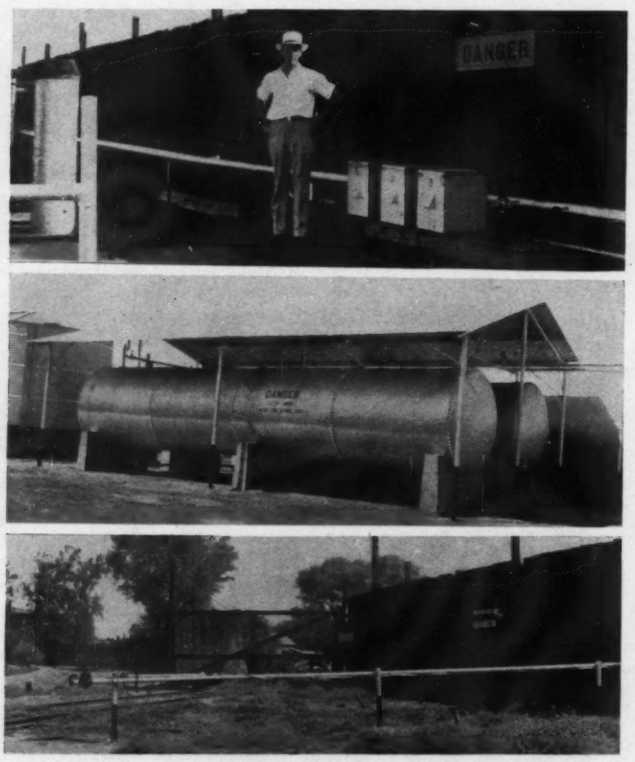
NEEDLES, Calif., has been served with gas and electricity for a number of years by the Needles Gas and Electric Co. The electricity is generated by Diesel power and the gas has been made in the usual fashion, serving a 550 B.t.u. oil gas. The gas was made into a relief holder, transferred through purifiers and an oil scrubber into the storage holder of 30,000-cu. ft. capacity and drawn thence by boosters and forced into the distribution system at from 1½ to 2 lbs. per square inch pressure. House regulators are used to reduce this pressure to about 6 inches of water column.

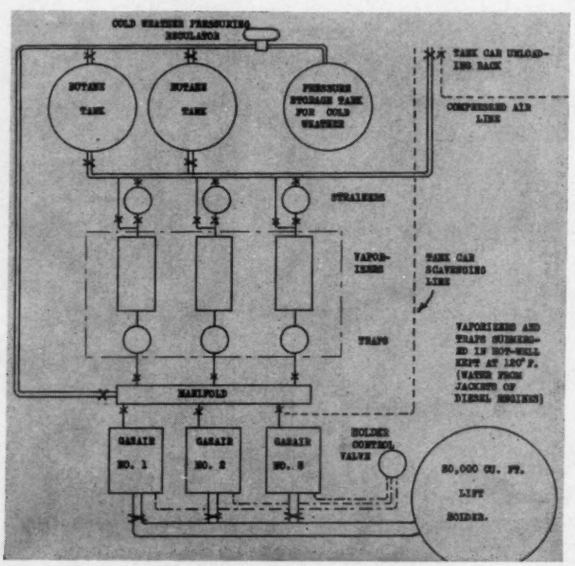
James A. Ward, president of the company, has been studying butane for a number of years and was particularly interested in the problem of substitution of butane-air for oil gas without appliance changes. Considerable experimental work has been done along this line, particularly by C. H. Webber of Tucson, Arizona, and it appeared that a butane-air mix of somewhere between 800 and 900 B.t.u. could be substituted for an oil gas of 550 B.t.u. using the same appliance orifices and pressures. The condition to be met in such a change-over was that the B.t.u. output of the burners should be about the same on either butane-air or oil gas. Since the butane-air is about three times as heavy as the oil gas and the amount of gas through an orifice varies as the square root of the gravity, the heat content of the butane-air would have to be increased to the point where the same number of B.t.u.'s would pass through the orifice.

The matter was discussed informally with the engineers of the California Railroad Commission, as it is obvious that it would not be economically feasible to serve a higher B.t.u. butane-air at the same cubic foot price as oil gas. The engineers suggested that the company go on the therm rate basis and indicated that they would be glad to cooperate insofar as possible.

Mr. Ward felt that a butane installation would be well justified as a stand-by measure alone, provided that the necessary equipment did not involve too great an expenditure. The further thought that butane could be used when the price of the oil was higher than the equivalent price of butane was also a governing factor in the decision to install the apparatus.

The writer was sent to Winslow, Arizona, to inspect the butane-air plant of the Arizona Gas Co. which had been in successful operation for about eight months using a very simple type of apparatus known as "Gasair" mixers. These mixers are essen-





ABOVE—Needles Gas and Electric butane hook-up diagram.

AT LEFT—(Upper): D. E. York and three "Gasairs" at Needles Plant. "Gasairs" mounted on top of hot well. (Center): Butane liquid storage tanks, shaded to keep down vapor pressure. (Lower): Tank car unloading rack.

tially an inspirating device wherein the power available in the vaporized butane under pressure is used to draw in and compress the necessary diluting air. It was found that very close B.t.u. control could be maintained with apparatus of this sort provided the inspirator ran at a definite capacity at all times. The control of the "Gasair," therefore, was arranged to turn the inspirator fully on or entirely off, and load variations were taken care of by allowing the machines to work for longer or shorter intervals.

In order to get a quick and economical trial of the "Gasair" apparatus in Needles it was decided to make gas directly into the low pressure holder and control the machines by the position of the holder. Reference to the diagram of the hook-up will show a "Holder Control Valve" which turns on No. 1 "Gasair" when the holder has dropped about 8 inches, No. 2 when an additional 8-inch drop has occurred, and No. 3 when another 8-inch drop takes place. In this way the full capacity of the three machines is in use when the holder has dropped 2 feet and at that time gas is being made at the rate of from 7500 to 8000 cu. ft. per hour. The holder is always practically full of gas and acts as a carry-over and stand-by should it be necessary to take the "Gasairs" out of service for a few hours. Inasmuch as one of the machines can be taken down and completely reassembled in half an hour this stand-by should be ample.

Vaporization

Hot water for vaporization is always available from the discharge from the cooling jackets of the Diesel engines driving the electric plant. This water is conducted into a hot well at about 120 degrees F. It was thought that submerging the vaporizers in this hot well would serve two purposes; first, the butane would be vaporized; and second, the water would be cooled somewhat, reducing the duty on the cool water pump used to circulate well water to cool the jacket water for the engines.

Vaporizers were made up from pipe on hand and consisted of one pipe inside another with the butane in the annular space between. One vaporizer was made of a piece of 10-inch pipe inside a piece of 12-inch, and two vaporizers were made of 4-inch inside 6-inch. Traps to prevent any liquid passing over to the "Gasairs" were made of pieces of 3-inch pipe capped on the ends and standing vertically in the hot-well. The vapor from the vaporizers enters these traps about half way up the side through an elbow which looks down on the inside of the trap. Dry vapor is taken from the top of the traps to the manifold supplying the "Gasairs."

Unloading Tank Cars

To simplify the problem of unloading tank cars of butane a vapor line was run from the top of the butane tanks to the "Gasair" manifold. In hot weather the vaporizers are shut off when unloading butane and vapor is taken from this line which cools the storage tanks and keeps the pressure down so that a smaller differential need be built up on the tank car for unloading.

An inexpensive innovation was incorporated in the lay-out to absolutely empty the tank car of butane. This is noted on the diagram as "Tank Car Scavenging Line" and consists of a piece of ½-inch copper tubing run from the unloading rack to a point near the vapor inlet on No. 3 "Gasair." After the tank car has been unloaded as far as possible by the use of the pressure differential method, the pressure hose to the car is disconnected from the air line and connected to this scavenging line. The other end of the scavenging line is connected to the vapor inlet on the No. 3 unit in place of the line from the manifold. The No. 3 unit then uses the vapors and mixture of vapor and air in the tank car to make gas into the holder. Naturally, the B.t.u. value of this gas will vary greatly from standard but this is observed by means of a Caloroptic calibrated Bunsen burner and one of the other "Gasairs" is run under hand control and adjusted to correct the B.t.u. value. In this way the tank car can be emptied right down to the pressure in the 30,000-foot holder, and no valuable butane is shipped back to the refinery.

Inasmuch as the "Gasairs" must have about 4 pounds vapor pressure to operate at all times, in cold weather some means must be supplied for furnishing this pressure. This was done by making use of an existing high pressure storage tank which feeds made gas into the top of the butane tanks through

PREFERRED BY THE LEADERS

When time and again Hackney Liquefied Petroleum Gas Cylinders are chosen by the leaders in the field, it becomes evident that they are the wise answer.

So powerful has Hackney become in the liquefied petroleum gas field that there are *two* Hackney cylinders in service to all others combined.

Hackney customers include: Shell, Standard, Skelly, Hope, Phillips, etc. And users of Hackney cylinders for other gases include: Mathieson, Virginia Smelting, R. & H. Chemical, Air Reduction Sales, etc.

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CONTAINERS FOR GASES. LIQUIDS AND SOLIDS

a pressure regulator when the vapor pressure in the tanks drops below the point at which the regulator is set. This high pressure tank also serves as an absolute final stand-by in the event of the failure of the butane plant and failure of the boosters between the low pressure holder and the distribution system. In such an event the high pressure tank will feed directly into the distribution system through a regulator set at about 1½ pounds pressure.

It was planned to go over the entire system and clean regulators and see that appliances were in reasonably good adjustment before turning in the butane-air. However, just as work was started on the butane plant the large oil gas generator burned out, necessitating running the small set at forced capacity. The small set began to show thin spots so it was a bit doubtful how long it would hold together. Work on the butane plant was therefore rushed as much as possible and butane-air turned into the system the night of June 13th. Whether the date had anything to do with it or not may be beside the point, but the next day the complaints began to roll in. It was found that the house regulators were badly gummed up with tar and napthalene which remained fairly soft while handling oil gas but which hardened and froze the regulators when the butane-air was turned in. Fortunately a sufficient stock of regulators and parts was on hand to permit changing and cleaning up so the service calls were all taken care of promptly. No other trouble of any moment occurred, so far as the customers were concerned.

Two tanks which had originally been used for high pressure storage of oil gas were used as butane storage tanks. These tanks had accumulated a considerable coating of iron sulphide which was not removed in the steaming and scrubbing to which they were subjected. The liquid butane apparently formed a new unstable sulphur compound with this iron sulphide, which compound broke down when the butane was vaporized and deposited free sulphur in the vaporizers. The vaporizers were provided with blow-offs so it has been possible to keep this sulphur from accumulating and it is thought that the trouble will soon be over. It has since been learned that one of the mining companies is using exactly the process which is taking place in the Needles gas plant for the recovery of sulphur from some of their sulphide ores.

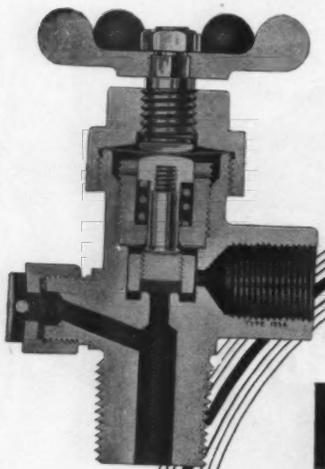
Fears were expressed that the "unaccounted-for" would become a serious problem when the butane-air had dried out the tar deposits in the distribution system. Some trouble of this sort has been showing up but so far it has been possible to keep ahead of it by judicious use of ethyl mercaptan and repairing of the leaks found. Odorization will normally be with Calodorant No. 3 fed into the system through a sight feed device.

At the present time, the "Gasairs" are making gas into the holder but it is planned later on to use them to make directly into the distribution system against the 2-pound pressure, and cut out the boosters. The low pressure holder and one booster will then be used on the peaks or in the event of a total failure of all "Gasairs."

J. E. Spelce and L. W. East, engineers of the Railroad Commission, conducted a number of tests at Needles on the interchangeability of the 550 B.t.u. oil gas and the 900 B.t.u. butane-air, and found that a practically perfect change-over could be made without any more trouble than opening the butane-air valve and closing the oil gas valve. The butane-air flame is a little shorter than the oil gas flame but the 900 B.t.u. gas burns very readily and has no great tendency to "lift" from the burner. The flame appears to be about like a natural gas flame but with a little better burning characteristics, due, no doubt, to the fact that part of the air for combustion is intimately mixed with the gas before it passes the burner orifice.

Gas Consumption Experience

In connection with the rate situation, 50 representative meters were read daily for a week on oil gas and the same meters were read for a similar period on butane-air. The agreement between the B.t.u. consumption on oil gas and butane-air was remarkable! By one method of calculation it checked within 7/100 of 1 per cent and by another method within 2½ per cent. That is, the consumption on butane-air was only 2½ per cent higher than on oil gas on a B.t.u. basis. Acting largely on this, the present rate schedule was rewritten in terms of "therms" (100,000 B.t.u.) and placed in effect subject to review after some period of time when more experience is available.



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Incorporating the soundest principle in the construction of cylinder valves yet developed . . . the result of over 12 years of progressive manufacture . . . triple metal diaphragms insure long, uninterrupted, gas-tight service . . . seat inserts and diaphragms readily renewed . . . diaphragm replacement while under pressure . . . positively sealed against leakage . . . has successfully withstood the Underwriters' Laboratories severe pressure tests of 11,250 lbs. per square inch without failure . . . so designed that years later every part may be individually serviced at a minimum cost.

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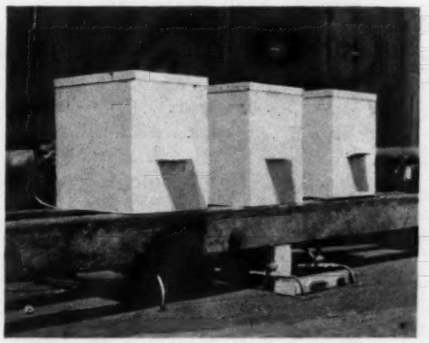
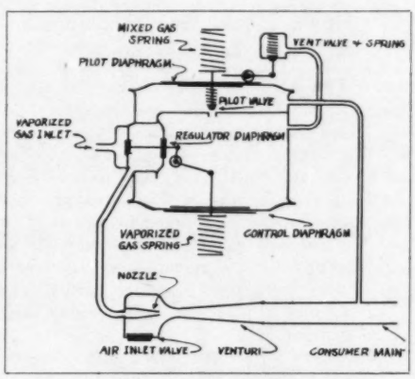
KEROTEST MANUFACTURING COMPANY
PITTSBURGH

"Gasair" Butane Mixer



Three "Gasairs" serving a town of 3000 population with 900 B.t.u. butane-air gas—capacity 200,000 cu. ft. per day.

- **Completely Automatic!**
- **Requires No Power!**
- **Proven Performance!**
- **Low Cost!**



TYPE S "GASAIR" UNIT
(Patent Applied For)

The "Gasair" unit is a simplified butane-air mixer requiring no power for its operation, no expensive foundations, and no buildings for its housing. This equipment makes gas service economically possible in even the smallest community, and will put profits into many small systems now operating on other service. It is also readily adaptable for installations off the natural gas line, or for emergency service during gas main repairs.

UTILITY DEVELOPMENT CO.

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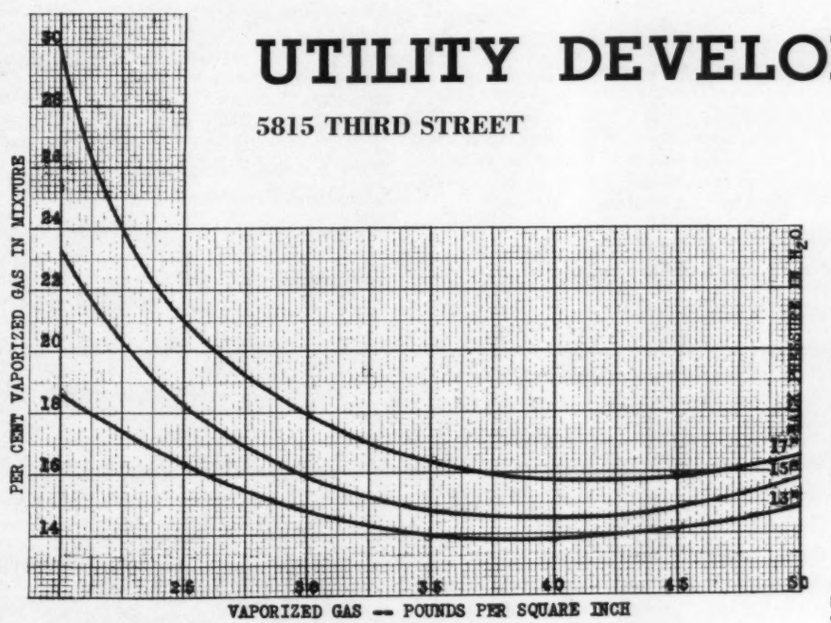
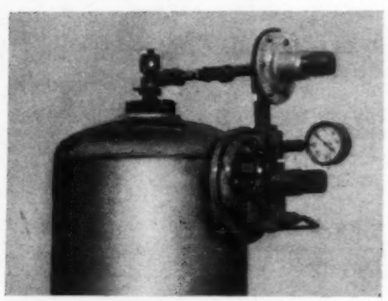


PERFORMANCE CURVES FOR "GASAIR" (TYPE S)—AIR TEST AT SEA LEVEL



EMERGENCY-TYPE "GASAIR" FOR TEMPORARY SERVICE

Furnishing a propane-air mixture that makes burner adjustments unnecessary in change-over or emergency stand-by for either natural or manufactured gas service. The cost of a unit is less than the cost of running a by-pass.

Reaction of the consumers has been very favorable. The new gas is clean and hot and should prove particularly good in the winter when many radiant-type heaters are used. The only complaints of note have been from customers who didn't realize that the new gas was much hotter than the old and served the head of the house with a well-done steak when he had ordered rare.

In the event that butane becomes too high in price, all that is necessary is to start the old oil gas plant and shut down the butane plant. Thus each plant becomes absolute stand-by for the other and permits operation on the fuel which may be most economical at any given time.

The installation of the butane-air plant was under the supervision of the writer. O. V. Johnson is manager at Needles and Leo Connors is chief plant engineer. The "Gasair" apparatus was furnished by the Utility Development Co. of San Francisco and was set up under the supervision of J. K. Heller of that company. A more complete description of this apparatus appeared in the February 1934 issue of *Western Gas* in an article by H. G. Laub, consulting engineer for the Arizona Gas Co., and engineer of the Southern California Gas Co.

Mono Basin Camps to Have Butane Gas Plants

FOUR butane plants are planned for construction camps on the Los Angeles Department of Water and Power Mono tunnel project, bids being submitted to the Department late in August. The camps will be located about 65 miles northwest of Bishop in the Mono Basin where temperatures range from 14 degrees below zero to a maximum of 98 degrees. They will be designated as West Portal, East Portal, Shaft No. 1, and Shaft No. 2 camps.

Specifications call for 10,000 gallon storage at each plant, with alternate of 20,000 gallon storage, and the proposed consumption will amount to 555,000 gallons annual capacity for the combined four camps. Undiluted vapor type plants will be used, to supply gas for the camps' domestic needs and also for such purposes as forges, blacksmith shop use, etc.

Separate bids in connection with the new gas plants are being let for appliances, including approximately 800 circulating heaters and 100 water heaters.

PWA Makes Grants For Butane Plants

Andalusia, Ala., has been granted a loan by the Public Works Administration amounting to $67,700 for the construction of a butane-air gas generating plant and distribution system. Troy, Ala. has also received a loan of $68,400 from the Administration for the erection of a gas plant. Charles A. McKeand and Associates, Troy, Ala., is installing the plants.

44 Per Cent Increase Reported In Stargas Sales

Lone Star Gas Co. reports a 44 per cent increase in Stargas sales for the six months ending June 30, over the same period of 1933, and a 25 per cent gain over the same period of 1932.

A. P. I.—A. S. M. E. Pressure Vessel Code Complete

THE joint American Petroleum Institute —American Society of Mechanical Engineers code for the design, construction, inspection, and repair of unfired pressure vessels for petroleum liquids and gases, is now on the press and will be available early in September at the American Society of Mechanical Engineers, 29 West 39th Street, New York, N. Y., at $1 per copy. This code represents the culmination of several years of intensive work on the part of the joint A.P.I.-A.S.M.E. committee and of the groups that have cooperated with it, particularly the sub-committee on unfired pressure vessels of the committee on standardization of refinery equipment of the division of refining of the American Petroleum Institute.

This first edition of the code covers both welded and riveted vessels for operation at gauge pressures above 15 pounds per square inch and at temperatures not over 1,000 degrees F. It is subdivided into four sections as follows: Section W—Fusion-welded Unfired Pressure Vessels; section R—Riveted Unfired Pressure Vessels; section I—Inspection, Repair, and Allowable Working Pressures for Unfired Pressure Vessels; section S —Material Specifications.

Membership of the joint committee includes Walter Samans, chairman; and R. P. Anderson, secretary. American Petroleum Institute: A. J. Ely, Standard Oil Development Co.; K. V. King, Standard Oil Co. of California (P. D. McElfish, alternate); R. C. Powell, The Texas Co.; Walter Samans, The Atlantic Refining Co.; T. D. Tifft, Sinclair Refining Co. The American Society of Mechanical Engineers: R. E. Cecil, William B. Scaife and Sons Co.; E. R. Fish, The Hartford Steam Boiler Inspection and Insurance Co.; D. S. Jacobus, Babcock and Wilcox Co.; T. McLean Jasper, A. O. Smith Corp.; James Partington, American Locomotive Co.

Plans For Bottled Gas Service To Panama City Area Enlarged

According to Carl M. Vick of the Panama Gas Co., Panama City, Fla., plans for the distribution of bottled gas to Panama City territory will include Panama City, St. Andrews, Millville, Lynn Haven, Bay Harbor, Port St. Joe, Apalachicola, Wewahitchka and several small towns within a radius of 50 miles. It is planned to use one drum service, refills to be made monthly. A merchandising sales room will be opened soon, according to present plans.

Propane Bulk Station Operating for Island Home Commodities, Inc.

Island Home Commodities, Inc., Wyandach, N. Y., has put into operation its new bulk station for distribution of bottled gas. A 12,500-gallon storage tank has been installed for the 7-70 wet-gas product and a tank of the same capacity for the storage of propane.

Island Home Commodities, Inc., is owned by Jacob Selikowitz, who is also owner of the Conservative Gas Co. Both properties are managed by Lou Selikowitz, his son.

Howard S. Bunn Becomes New Manager For Pyrofax

Carbide and Carbon Chemicals Corp., New York, N. Y., announces the appointment of Howard S. Bunn as manager of the Pyrofax division of the company, to succeed Morse G. Dial who has been made manager of the Vinylite division. Mr. Bunn has been associated with Pyrofax since its inception and for a number of years has taken an active part in the management of the division.

Clifford Manager Adv. and Sales Promotion for Skelgas

Skelgas Co., Kansas City, Mo., has established its own advertising and sales promotion department, with Harry Clifford as manager. This work was formerly handled by the advertising department of Skelly Oil Co.

Piping Liquid Gas to Shiprock, New Mex. Indian Agency

PLANS are going forward at the Shiprock, N. Mex., U. S. Government Indian Agency for installation of a natural gas distribution system as announced in *Western Gas* for April. Gas will be used for domestic service, and will also supply fuel for a power plant now being installed. The power plant will generate electricity for domestic service at the agency and for five government irrigation pumping plants. Two gas engines of 275 h.p. will operate the electric generators.

Gas will come from the Continental Oil Co.'s Rattlesnake oil field through a 7-mile, 2-inch all copper pipe line, copper being used due to severely corrosive soil conditions. The natural gas consists largely of liquid fractions, its analysis being approximately the following by weight: Methane, 6.86 per cent; ethane, 12.85 per cent; propane, 46.80 per cent; butane, 32.77 per cent, and pentane, .72 per cent.

New Concern Begins Activity In Liquefied Petroleum Gas Field

American Gas Service Co., Lima, Ohio, with R. M. Mead as manager, has begun liquefied petroleum gas service in the western section of Ohio, with Lima as headquarters.

Iowa Gas Service Co. of Des Moines has been established as an affiliate of the company to serve Iowa. American Gas Service Co. also expects to operate in western Michigan.

Changes in Philgas District Personnel

Clyde Street, formerly sales manager of Philgas Co. at Rockville, Md., has been transferred to the company's Richfield Springs, N. Y., office. He was replaced at Rockville by Herbert Bartholomew, formerly at Maywood, Ind. W. C. Newbolt has been transferred from Madison, Wis., to Washington, R. I., replacing J. T. Lowes, who has been sent to Detroit for general staff work at the main office of Philgas Co.

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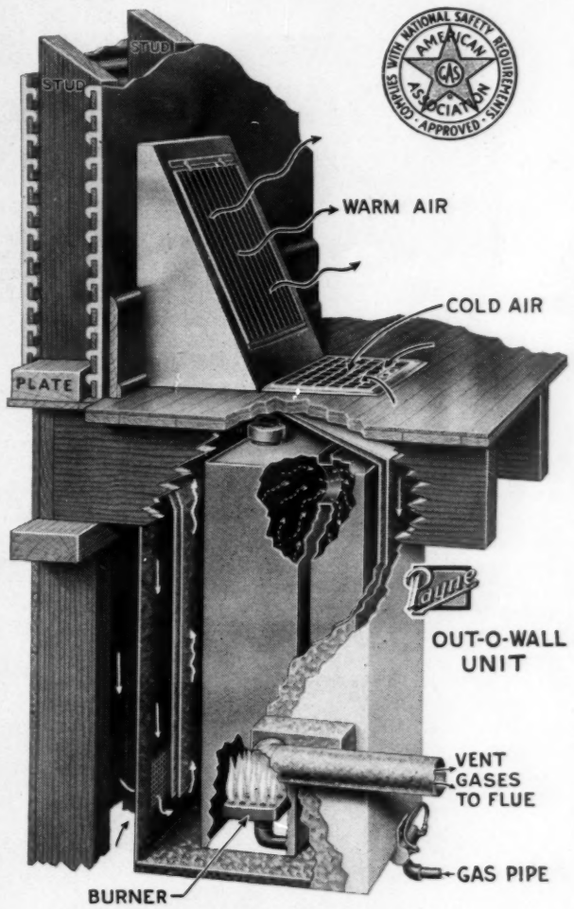

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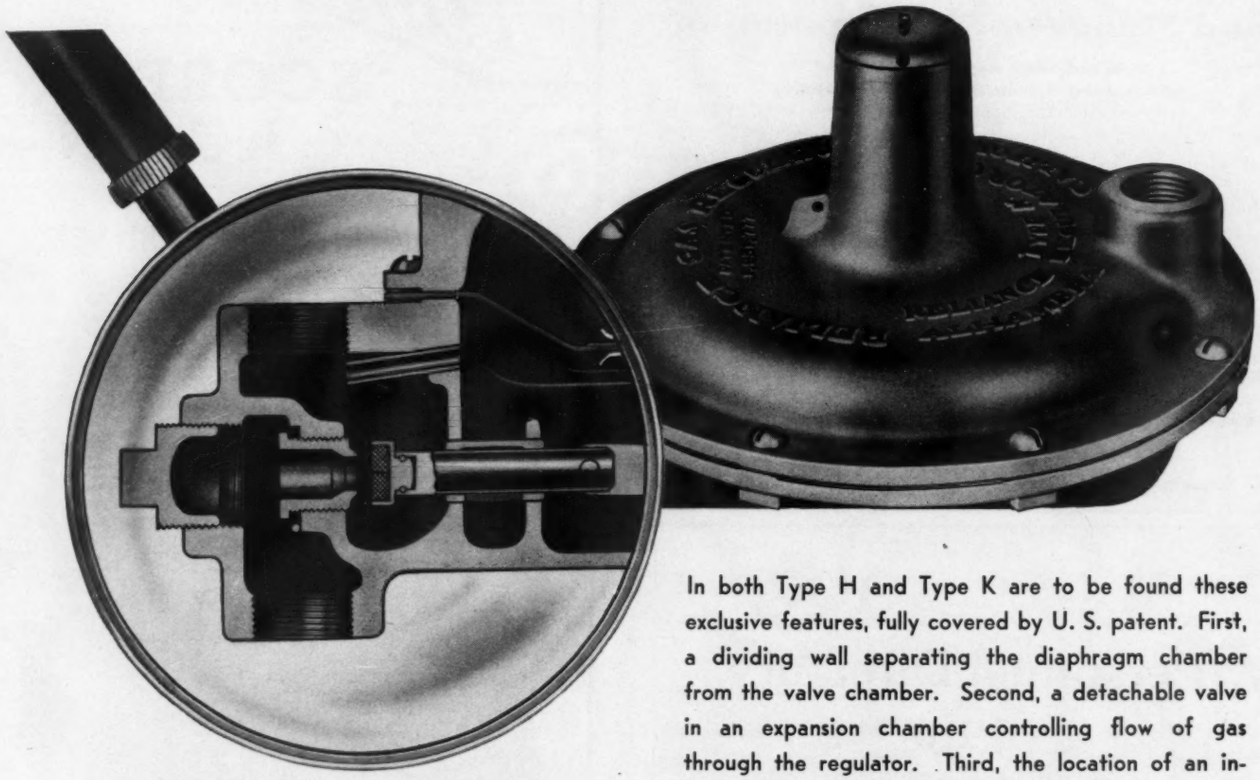

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MEASUREMENT and CONTROL

Summary of Recent Progress in Measurement of Fluids by Orifice Meter

By WILLIAM L. COWAN

*Union Oil Company of California**

IT IS the purpose of this paper to review a number of important current contributions bearing upon field measurement by orifice meter. The results of the studies dealt with have then been coordinated by the writer, and a few new and practical formulae developed by which Reynolds Numbers may be checked up easily for flow of any liquid and any gas. A number of actual problems have been worked out to show the range of variation in the coefficients which are likely to occur in practice.

William L. Cowan

Covered in the present review are the following three studies:

I. "Notes on the Orifice Meter and the Expansion Factor for Gases" by Edgar Buckingham of the U. S. Bureau of Standards. In this article Mr. Buckingham has prescribed certain limitations in orifice meter dimensions, given coefficients for throat taps and has shown a general formula for correcting for the change in density of gases passing through the orifice, as well as stating many other interesting and valuable facts in regard to orifice meter measurement.

II. "Viscosity of Natural Gas" by W. B. Berwald and T. W. Johnson, U. S. Bureau of Mines. Special reference is had to that part of the report which deals with the effects of viscosity upon orifice meter measurement.

III. "Determination of Discharge Coefficients for Sharp Edge Orifices" by Prof. S. R. Beitler of Ohio State University. Prof. Beitler conducted tests with water from which he has determined orifice meter coefficients based on a combination of Reynolds Numbers and orifice-to-pipe-diameter ratios. He has also determined limitations of the thickness of the edge of the orifice with respect to orifice diameter and to the dam set up by the orifice plate in the pipe. The only complete data published on these tests are that for vena contracta taps. However, by studying the following discussion of the method of determining coefficients for this type of taps, the reader should be able to quickly analyze Prof. Beitler's complete data on other types of taps, which will probably be published soon.

As the Beitler data were derived from experimental tests with water, a number of checks have been made showing the variation between them and their method of computing, and that published by Mr. Buckingham of the U. S. Bureau of Standards, the latter data being based on actual tests with gas. It should be remembered, however, that the comparison shown is that between throat and vena contracta taps, which give nearly, but not exactly, the same coefficients of discharge.

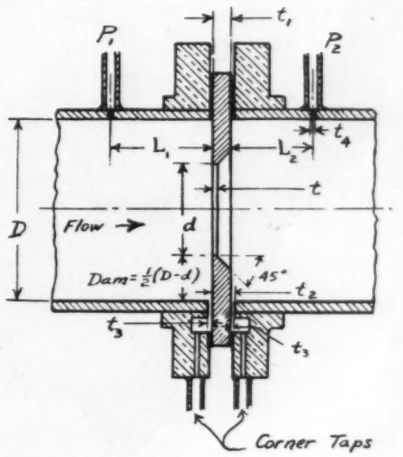

Fig. 1.

I. "NOTES ON THE ORIFICE METER AND EXPANSION FACTOR FOR GASES" BY EDGAR BUCKINGHAM, U. S. BUREAU OF STANDARDS†

(1) Specification of Standard Pressure Tap Locations (See Fig. 1)

(a) Pipe Taps: $L_1 = 2.5$ D and $L_2 = 8.$D.

(b) Throat Taps: $L_1 = $ D and $L_2 = 0.5$D.

(c) Flange Taps: $L_1 = L_2 =$ 1-inch for all sizes of pipe.

(d) Corner Taps: The side holes are at the faces of the plate or the pressures are taken off through narrow circumferential slits between the plate and the flanges.

(2) Specifications of Bureau of Standards Orifice Meter

(a) Flow rate through orifice must be such that R, the Reynolds Number, be greater than 200,000. All statements shown are based upon this assumption being true.

(b) Orifice plate must be concentric with pipe; the edge of orifice upstream must be at right angles to axis of pipe; orifice edge must be sharp and free from burrs.

(c) Thickness (t) of orifice plate at orifice opening must be such that (t) be not more than 0.03 D nor less than 0.01 D.

(d) Total plate thickness (t_1) must be equal to or less than 0.1D.

(e) Pressure tap openings (t_4) must be equal to or less than 0.03D.

(f) Bevel, if any, must be 45° and on downstream side of plate.

Note: It is of interest that specifications from the German Regeln call for (t_3) equal or less than 0.03D; dimension (t_2) is given in the German Regeln equal or less than 0.1D.

(3) Comparison of Flange Taps to Corner Taps

"Flange taps" may be considered equivalent to "corner taps," except for high precision work, when pipe diameter (D) is 8 inches or greater, and the diameter ratio (d/D) is less than 0.75.

(4) Comparison of Throat Taps to Vena Contracta Taps

Vena contracta taps represent the upstream pressure as the pressure of gas stream just prior to converging toward orifice while downstream pressure is the pressure in jet at vena contracta.

For (d/D) less than 0.75 as long as the upstream tap location (L_1) lies within limits (0.5D to 2.D) and the downstream tap is located at $L_2 = 0.5$ D, the difference between throat and vena contracta taps may be assumed as not more than .005 ($P_1 - P_2$) or a difference of 0.25 per cent in the coefficient of discharge if Reynolds Number is greater than 200,000.

(5) Reynolds Criterion

It is assumed that the coefficient of discharge for a given orifice is constant if the Reynolds Number is above 200,000.

(6) The Water Coefficient (K)

Used by the Bureau of Standards, and assumed to be a constant, this coefficient represents the orifice discharge coefficient for a non-compressible liquid where the Reynolds Number is greater than 200,000. This coefficient (K) includes the velocity of approach factor (F) where $F = 1/\sqrt{1-B^4}$ and $B = d/D$.

Letting C = Actual orifice discharge coefficient (not including F) for water, then $K = CF$ for a fluid of constant density if R is greater than 200,000.

*Presented before the Southern California Meter Association, June 28, 1934.

†Reference: U. S. Bureau of Standards Journal of Research, July, 1932.

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(7) The Expansion Factor (W) for Gases

However, gas is a compressible fluid and its density is not constant. Even though a high Reynolds Number is obtained the coefficient of discharge (C) varies appreciably for various pressure drop ratios $(P_2/P_1) = y$, P_1 and P_2 being the absolute upstream and downstream pressures respectively, even though the same gas is flowing through the same orifice meter.

This variation in (C) for gases with changes in (y) has been shown to be a function of the diameter ratio (B), the pressure drop ratio (y), and the ratio of specific heat of the gas (Z).

Mr. Bean and Mr. Buckingham have shown that for any of the tap systems having L_1 equal or less than 2D, and L_2 equal or less than 0.5D, this correction to C or K can be expressed by the following equation, where

C^1 = Corrected gas coefficient including velocity of approach

K = Water gas coefficient including velocity of approach

P_1 = Upstream pressure used in computing flow

W = Expansion factor

$$C^1 = WK = WCF \quad \text{and} \quad W = C^1/K$$

$$W = 1 - \frac{0.41 + 0.35\,B^4}{Z} \times (1 - y)$$

Accuracy of this equation gives results within + or − 0.5 per cent if (y) is greater than 0.8. It is applicable to corner, flange, throat and vena contracta taps but not to pipe taps.

Note: This expansion factor does not compare to the supercompressibility or so-called deviation factor often represented as (Y) for high pressure gas measurement. For high gas pressures usually the ratio (y) is high and consequently (W) approaches 1.00 and (C^1) approaches (K).

This formula for (W) cannot be used when the downstream pressure P_2 is used in the calculations unless the factor $(1/\sqrt{y})$ is applied to the whole flow formula.

An example illustrating the magnitude of this correction (W) to commercial measurement of natural gas is as follows:

Let B =.6209; y =.80; Z = 1.283; D = 8.05 inches; d = 5.00 inches.

$$W = 1 - \frac{0.41 + .35 \times .6209^4}{1.283} \times (1 - .8) = .928$$

for throat taps.

K for this orifice =.667; C^1 therefore = .619 or a difference of about 7 per cent. The pressure drop ratio y = 0.8 will exist with a 20 inch water differential and a 20 inch vacuum, 49 inch water differential and a 12 inch vacuum, 81 inch water differential and atmospheric pressure.

(8) Conclusion

There is no doubt but that this correction is a very vital one and should be given a great deal of consideration particularly in low pressure gas measurement. Whether the use of Beitler's data will possibly supplant the Bureau of Standards Method is a question at this time. It appears that the latter is a little more practical for commercial work, being simpler and offering a much more routine method of calculating coefficients than Beitler's method. Both methods necessitate at least an approximate check of the Reynolds Number.

Bureau of Standards data are based upon results of many experimental tests, particularly, however, those tests made by H. S. Bean at Los Angeles in 1929, using natural gas as the fluid medium.

The value of (W) for diameter ratios less than 0.2 or greater than .75 probably cannot be accurately determined from the above formula and therefore it would not seem advisable to use plates outside this range of B.

Actual application of the expansion factor method to computation of gas volumes will be shown later in examples comparing it and the Reynolds Number method.

II. "VISCOSITY OF NATURAL GAS" BY W. B. BERWALD AND T. W. JOHNSON, U. S. BUREAU OF MINES*

The viscosity of a fluid can be found directly by either of the two following methods. (1) Measurement of resistance offered to a moving solid body in contact with the fluid, and, (2) Measurement of rate of flow of a fluid.

The latter method is the one best fitted for measuring the viscosity of gases and is the one adopted by the U. S. Bureau of Mines.

In this method, the gas to be tested is passed through a coil of small hollow tubing immersed in a constant temperature bath. The gas leaving the coil at atmospheric pressure is measured accurately. By determining the pressure drop, the mean velocity, the mean density and the dimensions of the coils, the "Friction Factor" can be obtained for the gas in question. By first plotting "Friction Factor" versus "Reynolds Criterion" for a gas of known viscosity (usually air) for the coil used, then determining from this curve the "Reynolds Criterion" for the gas being tested by its measured "Friction Factor," the viscosity of the gas can be calculated directly.

*U. S. Bureau of Mines Technical Paper No. 555.

TABLE NO. 1.

Fluid	Viscosity in Pounds per Sec. Foot At 40° F.	At 150° F.	Diff.	% Variation Over Viscosity At 40°F.
Air	.00001165	.00001365	.00000200	+17.2
Methane	.00000700	.00000830	.00000130	+18.6
Methane 81% Ethane 19%	.00000670	.00000788	.00000118	+17.6
Methane 63% Propane 37%	.00000605	.00000730	.00000125	+20.7
Water	.000940	.000302	.000638	—67.9

The above method is quite simple, and gives quite accurate results, which may be summarized as follows:

(1) Variation of Viscosity with Pressure: Viscosities of real gases are usually very little affected by changes in pressure.

(2) Variation of Viscosity with Temperature: The viscosity of most gases is increased as the temperature is increased. The magnitude of this change is as shown in Table No. 1.

(3) Units of Viscosity and Conversion Factors:

1 Centipoise = 0.01 Poise = Viscosity of water at 68° F.

1 Poise = .0672 Pounds per second foot.

1 Pound per second foot = 14.89 poises.

Application of Reynolds Number to Flow of Gas Through Pipe Lines and Orifices

Osborn Reynolds in 1883 investigated fluid movements through tubes of similar dimensions and observed that—

(a) As velocity of flow increased there was a critical point at which character of flow suddenly changed from a straight line to a turbulent or eddying-type motion.

(b) Critical flow occurred at different velocities, depending upon tube diameter and properties of fluid. This point was a function of the ratio of (tube diameter × density × velocity)/Viscosity = R which is called the "Reynolds Criterion" or "Number."

Lord Rayleigh later stated that:

"Frictional resistance per unit of surface area in contact with the fluid divided by product of fluid density and the velocity squared is equal to some function of Reynolds Number.

"Turbulent flow usually occurs when R is greater than 3000.

"Viscous or straight line flow occurs when R is less than 3000.

"The coefficient of friction increases rapidly as R decreases below 3000 while the friction factor changes slowly and decreases for increasing values of R greater than 3000."

Most gas transmission lines in commercial use show turbulent flow.

Almost all flow of gas through orifices is also necessarily of a turbulent character as the R recommended is 200,000 or greater. Under ordinary orifice meter measurement of gas the orifice coefficients are therefore relatively constant.

The following relation, (d^2Ph is greater than 10) has heretofore been somewhat accepted as an accurate criterion to follow in the measurement of air by orifice meter at ordinary temperatures and diameter ratios between 0.2 and 0.6, in order to eliminate the effects of viscosity.

In the above relation d = orifice diameter in inches; P = absolute static pressure in pounds per square inch; and h = differential pressure in inches of water.

To illustrate the meaning of the expression (d^2Ph is greater than 10) in terms of the true Reynolds Number, it is necessary to first make a few assumptions. The following conditions probably give about as low a value of (R) as occurs in practice.

Let C = 0.6; T = 120° F. = 580° F. abs.; F = 1.0. Let the fluid be air, with a viscosity of .0000132 at 120° F. Then

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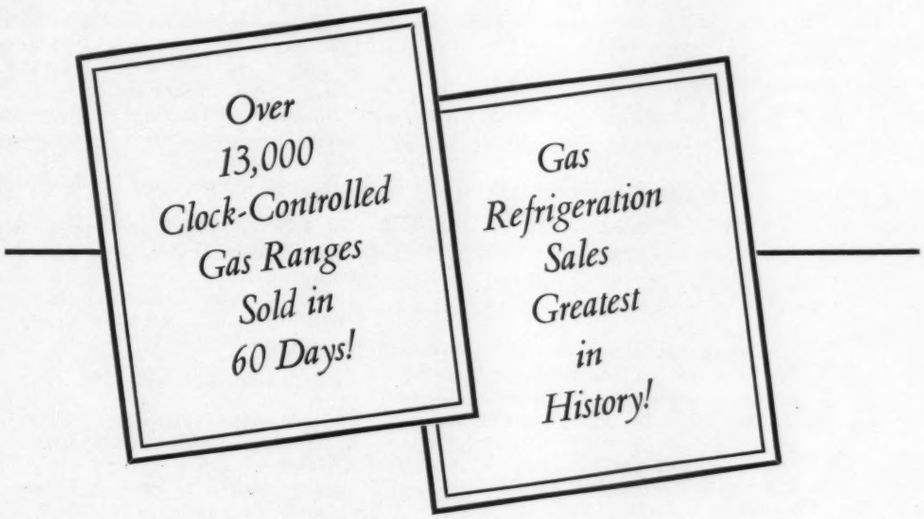

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TABLE NO. 2. (Reference Fig. 1.)

D (Inches Approx.)	t_1 (Inches)	(d) (Inches)	d/D	Used 45° Beveled Orifice
1.0	1/8	1/8 — 3/4	0.24 — 0.77	Yes
1.5	1/8	1/8 — 1 1/8	0.15 — 0.76	Yes
2.0	1/8	1/8 — 1 5/8	0.06 — 0.80	Yes
2.0	1/8	3 special check orifices	0.12 — 0.25	Yes
3.0	1/8	1/4 — 2 3/8	0.08 — 0.78	No
6.0	1/8	1/4 — 4.8	0.04 — 0.79	No
10.0	1/8	2.0 — 8.2	0.19 — 0.81	No
14.0	1/4	3.0—12.0	0.21 — 0.85	No
Special Tests				
10.0	1/2	2.0	0.20	No
14.0	0.8	3.0	0.21	No

$$R = \frac{2.503 \times .6 \times 1.0 \times d\sqrt{hP \times 1.0/580}}{.0000132} =$$

$$4720\, d\sqrt{hP}.$$

If $d^2hP = 10$ then $R = 14{,}950$.

If (R) be assumed as equal to 200,000 for same conditions as above,

$$200{,}000 = 4720\, d\sqrt{hP}, \text{ and}$$

$d^2hP = 1800$, which comes far from fulfilling the original relation, $(d^2hP = 10)$

If R be assumed to = 200,000 and a natural gas of gravity .644; temperature 580°F.abs.; viscosity .0000077; and F = 1,000; then

$$R = \frac{2.503 \times .6 \times 1.0 \times d\sqrt{hP \times .644/580}}{.0000077}$$

and $d^2hP = 950$.

Character of Flow in Meter Tube: The flow of fluid in the meter tube before and after the effects of the orifice are overcome can be shown to lie in the turbulent flow region in almost all instances; that is, the Reynolds Number will ordinarily be greater than 3000.

If (R) for the flow at the orifice is known, the approximate (R) for the pipe can be computed quickly from the following considerations. Velocity in pipe = Velocity at orifice $\times (d/D)^2$.
Then

$$R_{pipe} = R_{orifice} \times (d/D)^2 \times (D/d) =$$

$$R_{orifice} \times (d/D)$$

Turbulent and Viscous Flow: Turbulent flow is an eddying type of fluid motion. In orifice meter tubes this turbulent flow should be of a uniform type; that is, at any equal radius the velocity in the pipe should be equal, although the velocities at varying radii are different, being lower at the edge of the pipe than at the center. Straightening vanes are used to prevent a swirling motion of the fluid as well as to equalize the velocity traverse across the pipe.

Viscous flow is more of the straight line type, movement being parallel to pipe axis, the fluid tending to stick to the pipe walls, the fluid particles tending to adhere to each other. The velocity parallel to the pipe's axis at the center is much greater in proportion to velocity at edge of pipe than in turbulent flow.

Effect of viscous flow through an orifice is first to reduce jet contraction, causing orifice discharge coefficient to increase. Greater viscosity effects eventually become sufficiently great to cause so much resistance to flow that a greater pressure drop is required, which naturally tends to reduce the discharge coefficient.

III. Summary of S. R. Beitler's Test Procedure for "Determination of Discharge Coefficients for Sharp Edge Orifices In 1 Inch to 14 Inch Pipes," By S. R. Beitler, Ohio State University.*

These tests were conducted under the supervision of Prof. S. R. Beitler at Ohio State University in 1933. The tests were run under recommendations received from H. S. Bean and Edgar Buckingham of the U. S. Bureau of Standards, and R. E. Sprinkle of Bailey Meter Co. They represent perhaps the most complete and authentic test data published to date, particularly for water.

The fluid used during all tests was water. However, by the consideration of the "Reynolds Number" of any fluid for the orifice meter conditions of flow existing, it is believed that the coefficients are directly applicable to all other fluids.

Test data consisted of flow for Reynolds Numbers between 10,000 and 50,000,000 and orifice diameter to pipe diameter ratios .05 to .85.

Referring to Fig. 1, pressures P_1 were taken at 2½ pipe diameters; 1 pipe diameter; 1-inch; and at the edge of the orifice on the upstream side of the orifice. Pressures P_2 were taken at 0.4, 0.5, 0.6, 0.7, 0.8 and 8 pipe diameters, also 1 inch, and at edge of the orifice on the downstream side of the orifice.

The data shown for orifice meter coefficients derived from Reynolds Numbers are based only on plate thicknesses (t) such that d/t equals or is greater than 8 and (D—d)/2t equals or is greater than 4. All plates for 1-, 1-½-and 2-inch pipes were beveled at a 45° angle on downstream side.

In all, there were 65 plates tested. All plates were made by regular commercial companies. Of the original set of plates received only 10 per cent showed an appreciable rounding of the orifice edge.

Each plate was tested with differential flows of h= 0.4, 0.8, 2, 4, 6, and 9 feet of water, making in all 1008 separate runs. Table No. 2 shows the range of plates tested.

Method of Final Analysis

The theoretical volume of flow was calculated for each authentic run including the velocity of approach factor but not the actual orifice discharge coefficient.

Actual orifice discharge coefficient was obtained by ratio of actual flow to theoretical flow for each run.

Reynolds Number was calculated for each run.

Plots of orifice coefficients versus equal Reynolds Numbers having same diameter ratios were then made.

Plots of orifice coefficients versus diameter ratios for similar Reynolds Numbers were then drawn.

Prof. Beitler's Conclusions

Coefficients of discharge were very hard to reproduce at high and low diameter ratios. Recommendations are that (d/D) equals or is less than .75 and (d/D) equals or is greater than .2.

Apparently pipe size has no particular bearing on the coefficient of discharge other than its effect upon the Reynolds Numbers.

The effect of pipe roughness seemed to have no regular effect on the coefficient of discharge.

Small pipes do not give constantly higher coefficients of discharge for same (d/D) ratios.

The coefficient of discharge does vary with the Reynolds Number.

The effect of orifice thickness (t) necessitates use of a correction factor when (8t) is greater than (d) and also when (8t) is greater than (D—d). Correction factors for these values are shown in Fig. 2 and Fig. 3.

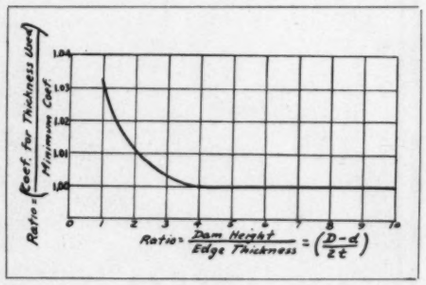

FIG. 2.

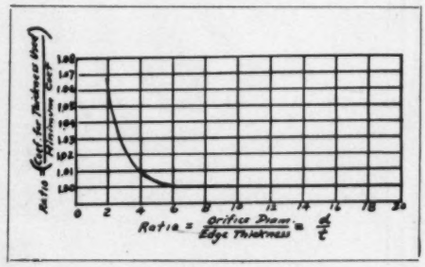

FIG. 3.

Fig. 2 and Fig. 3 are S. R. Beitler's curves showing effect of orifice edge thickness upon orifice coefficients.

* Summary of test procedure section of article by S. R. Beitler, "Instruments," January, 1934.

SUMMER SHOWERS

Emphasizing the convenience of summer showers via an Automatic Water Heater, the Gas Appliance Association of San Diego County in cooperation with this Company reports—

The sale of approximately 450 automatic water heaters during a campaign carried on in April. This is six times the number sold in April, 1933. Of these water heaters 270 qualified for bonus in accordance with the terms offered by the San Diego Consolidated Gas and Electric Company. The average sale price of the 270 was $53.63. Seventeen makes were represented and 160 were sold by plumbers, 38 by specialty appliance dealers, 67 by department stores and 5 by miscellaneous outlets.

Plans are now being rushed to encourage the sale of gas equipment under the Federal Housing Act. As announced on August 16th, the first approved San Diego County application for a loan under the provisions of the act included a central heating installation.

SAN DIEGO CONSOLIDATED GAS & ELECTRIC COMPANY

Welcome To Convention Land

Santa Cruz extends her hospitality to utility men and their families in all parts of the country at all times of the year.

We especially invite the members of the Pacific Coast Gas Association to acquaint themselves with our facilities for golf, sea bathing, fishing, hunting, or just plain "lazing around" on their way to or from the Convention at Del Monte.

Sales Representatives and "pedlers" are always welcome—the thoughtful ones bring their wives and make it a week-end.

Santa Cruz is the home of the general office of

Coast Counties Gas & Electric Company

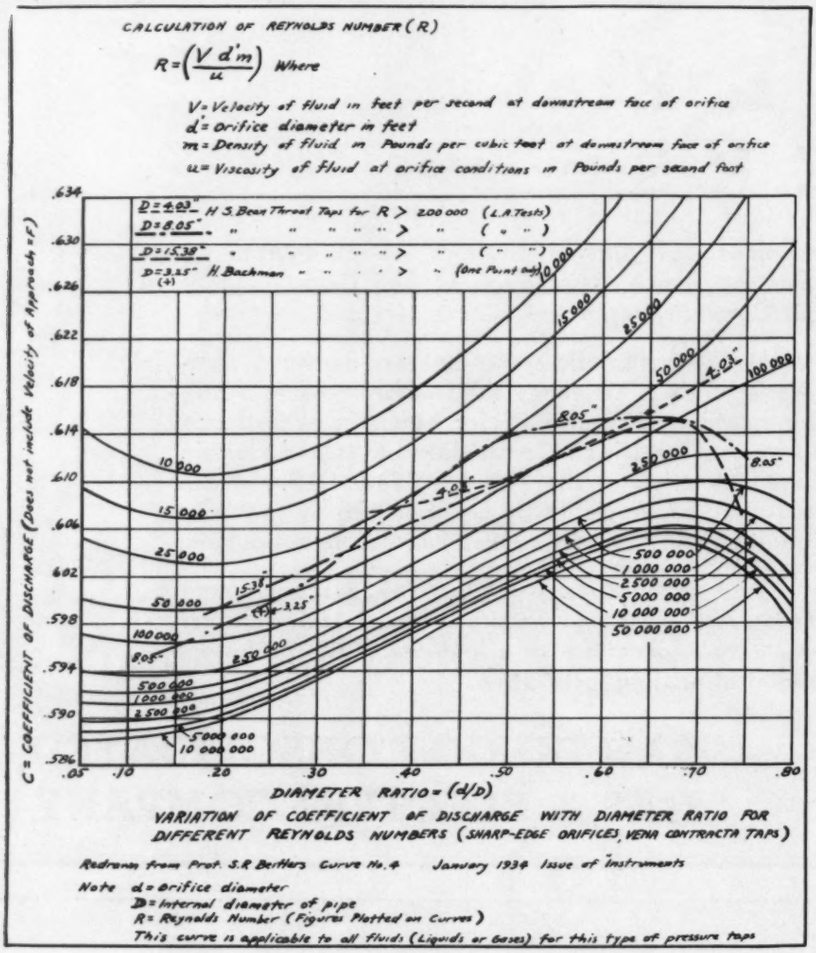
CALCULATION OF REYNOLDS NUMBER (R)
R = (V d' m / u) Where
V = Velocity of fluid in feet per second at downstream face of orifice
d' = Orifice diameter in feet
m = Density of fluid in Pounds per cubic foot at downstream face of orifice
u = Viscosity of fluid at orifice conditions in Pounds per second foot
D = 4.03" H.S. Bean Throat Taps for R > 200 000 (L.A. Tests)
D = 8.05" " " " " " > " (" ")
D = 15.38" " " " " " > " (" ")
D = 3.25" (+) H. Bachman " " " " > " (One Point only)
C = COEFFICIENT OF DISCHARGE (Does not include Velocity of Approach = F)
DIAMETER RATIO = (d/D)
VARIATION OF COEFFICIENT OF DISCHARGE WITH DIAMETER RATIO FOR DIFFERENT REYNOLDS NUMBERS (SHARP-EDGE ORIFICES, VENA CONTRACTA TAPS)
Redrawn from Prof. S.R. Beitler's Curve No. 4 January 1934 Issue of "Instruments"
Note d = Orifice diameter
D = Internal diameter of pipe
R = Reynolds Number (Figures Plotted on Curves)
This curve is applicable to all fluids (Liquids or Gases) for this type of pressure taps

Fig. 4.

A plate having a thickness $t_1 = 1/8$ inches is recommended for all but larger size lines. (Line size not stated, but probably greater than 12 inches.)

A beveled edge plate is recommended, such that edge thickness (t) at orifice is 1/32-inch for all orifices above ¼ inch in lines 1-½ inches and above.

Coefficients of discharge are not a constant at Reynolds Numbers of 100,000 or more for any given diameter ratio.

Accuracy of flow results for any orifice installed in the recommended manner, and with pressures, differentials, temperatures, gravities, etc., properly determined, should be within ½ per cent if orifice-to-pipe ratios lie within range (d/D) equals or is less than .75 and (d/D) equals or is greater than .2 vena contracta taps.

For (d/D) at lower values this tolerance must be increased, as for example at (d/D) = 0.1 tolerance = 1.0 per cent.

Orifices less than ½ inch are very hard to duplicate.

Orifices in lines where D is less than 2.0 inches should be calibrated individually.

While Prof. Beitler shows only vena contracta and corner taps in the paper reviewed above, he states that curves for throat and flange taps are quite similar except at higher values of (d/D) and that absolute values are somewhat different. Pipe taps show about the same differences for variation of Reynolds Number and about the same consistency for (d/D) up to about 0.50. Higher values of (d/D) than this are very much affected by pipe roughness and so were not at all consistent, and therefore pipe tap coefficients for (d/D) greater than 0.5 are difficult to predict.

Prof. Beitler states that he will publish the complete results of his tests for all of the different tap systems in the near future. The Beitler coefficients of discharge for vena contracta taps are shown in Fig 4.

Editor's Note: The second installment of Mr. Cowan's paper, dealing with application of the foregoing data to commercial measurement procedure and formulae, will appear in *Western Gas* for October.

Bulletin on Compressor Regulator

The Chaplin-Fulton Manufacturing Co. has issued Bulletin No. 130, describing its compressor regulator for controlling discharge pressure on constant speed compressors. A copy may be obtained by addressing the company at 28 Penn Avenue, Pittsburgh, Pa.

C. A. Swigart To Chicago Meeting

C. A. Swigart, Los Angeles, in his capacity as Pacific Coast representative of Frazer and Torbet, agent of the Gas Appliance Institute, will attend the annual meeting of the Institute in Chicago, September 17-18.

A.G.A. Publicity and Advertising Committee Members Announced

Henry Obermeyer

MEMBERS of the recently created publicity and advertising committee of the American Gas Association, announced by Managing Director Forward, are: Henry Obermeyer, assistant to the vice-president, Consolidated Gas Co. of New York, N. Y., chairman; Kenneth Magers, publicity manager, The Union Gas and Electric Co., Cincinnati, Ohio; R. S. McCarty, manager, advertising department, Philadelphia Co., Pittsburgh, Pa.; H. W. Olcott, Jr., advertising manager, The Philadelphia Gas Works Co., Philadelphia, Pa.; D. D. Parry, advertising manager, Central Hudson Gas and Electric Corp., Poughkeepsie, N. Y., and William Reynolds, advertising manager, Electrolux, Inc., New York, N. Y.

As chairman of the committee, Mr. Obermeyer automatically becomes a member of the executive board of the association.

No Municipal Plant for Parsons

The city commissioners of Parsons, Kan., unanimously voted August 3 to call off the special election scheduled for August to decide on a $275,000 bond issue for the construction of a municipal gas plant. Parsons is served by the Union Public Service Co.

1934 Calendar

September

Second International Gas Conference, International Gas Union—Zurick, Switzerland, September 1-4.

Wisconsin Utilities Association, Commercial Section—Hotel Pfister, Milwaukee, Wis., September 10-11.

American Chemical Society, Division of Gas and Fuel Chemistry—Cleveland, Ohio, September 9-14.

Pacific Coast Gas Association—41st Annual Convention, Hotel Del Monte, Del Monte, Calif., September 11-13.

Midwest Industrial Gas Sales Council—Palmer House, Chicago, Ill., September 21.

Southern California Meter Association—Long Beach, Calif., September 27.

October

National Safety Council - American Society of Safety Engineers—Joint Sessions, Cleveland, Statler, Carter and Hollenden Hotels, Cleveland, Ohio, October 1-5.

American Gas Association—16th Annual Convention, Atlantic City, N. J., Week of October 29.

MODERN METHODS AND MATERIALS

A letter to WESTERN GAS will bring you any of the selected reference bulletins listed below, without cost. Indicate by number which you desire.

NO. 22—HUMIDIFIER

Catalog describing new type gas air humidifier which incorporates air conditioning features. Cut-away illustrations of new equipment. 8 pages.

NO. 23—WATER HEATING DATA

Engineering data for computing hot water requirements and estimating fuel consumption in hot water heating. Numerous tables on temperature rise, hot water demand, maximum flow in gallons for various fixtures, sizes of hot water mains and risers. 8 pages.

NO. 24—PACKING MATERIALS

Complete line of packing described and illustrated; 60 different types, including packings for rods and plungers, pistons, pump valves; sheet and groove packing, lubricating seal rings. Instructions on gasketing, packing symbols, weights. 48 pages, numerous illustrations.

NO. 25—THERMOSTAT

Description of new type heat accelerating thermostat with specifications, instructions for location, wiring, connection, testing and adjusting. 4 pages, with diagrams.

NO. 26—GAS CLEANERS

Literature on two new types of gas cleaners, with diagrams.

NO. 27—HARD-FACING PROCEDURE

Methods and materials for hard-facing and hard-setting well drilling tools and wearing surfaces of other equipment. Physical properties of hard-facing and hard-setting materials. Procedure described and illustrated. Performance records given. 36 pages.

NO. 28—ROTARY GAS BOOSTERS

Specifications for line of rotary gas boosters with illustrations of various models.

NO. 29—AIR HOIST

Single and double drum type air hoist described, with tables of capacities, lifting speeds. Radial air motor used on hoist; loading slides; cable equipment. 32 pages, with numerous illustrations.

NO. 30—TEMPERATURE REGULATION

Two bulletins on specifications for new system of temperature regulation and automatic switches for heating equipment control. Typical performance charts, diagrams for location of equipment.

NO. 31—BOILER METERS

Boiler meters for several fuels including gas. Method of firing boilers. Illustrations and plant data on numerous installations. 32 pages.

Announcing...

METAL-BESTOS GAS VENT *and* FLUE PIPE

NEW in design and construction, yet old in principle, this pipe is now offered to the trade as being the most efficient, durable and safe pipe on the market—not "just another pipe." It is as carefully and faultlessly designed and constructed, in relation to gas and gas appliances, as modern engineering and manufacturing facilities make possible.

METAL-BESTOS is the most efficient pipe because of its high insulating value, there being one half inch of asbestos around inner pipe and fittings. It is most durable because the inner shell is made of 99% pure aluminum—the metal so extensively used in the manufacture of cooking utensils which stand up under the action of direct gas flames indefinitely. It is safer because of its always cool outside surface which eliminates fire hazard, because its crimped opposite ends of inner and outer pipes and fittings make for leak-proof connections and because the outside galvanized iron jacket protects the insulation against disintegration through exposure to moisture.

In keeping with PAYNE policy and products, METAL-BESTOS has been time tested before being offered to the trade. Actual installations and severe heat and acid tests have proved conclusively the merits of this product and building inspectors are daily endorsing its use in leading cities and towns.

Trial installations will prove the following points:

1... Better and quicker draft.
2... Improved combustion.
3... Elimination of excessive condensing of combustion products.
4... Longer life of appliance.
5... Less fire hazard.
6... Lower installation cost.

Write us for descriptive folder and price list covering METAL BESTOS . . . . the aluminum lined gas vent.

A New Payne Product

Manufactured by
PAYNE FURNACE & SUPPLY COMPANY
Established 1912
Beverly Hills, California

The Goodman Stopper

The Reliable Shut-off for Street Mains

Equipped with Improved Patented Locking Sleeve, which locks both handles to the pipe. Stopper cannot slip. Gas cannot pass.

GOODMAN — USED SINCE 1897 — 2" HANDLE & LOCKING SLEEVE — GAS MAIN STOPPER

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523 Atlantic Avenue, Brooklyn, N. Y.

Pac. Coast Rep.: C. B. Babcock Co.
135 Bluxome Street
San Francisco, California

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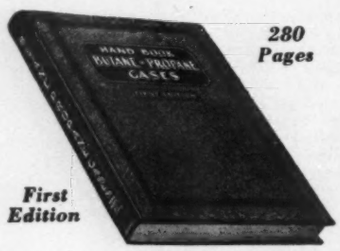
A COMPLETE REFERENCE ON

BUTANE-PROPANE GASES



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- Central Plants for Undiluted Butane-Propane Vapor Service.
- Liquefied Petroleum Gases as Industrial Fuels.
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- Miscellaneous.
- Catalog Section.
- Buyers' Guide.
- Directory of Central Plants.
- Bibliography.
- Index.

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Send $5.00 to WESTERN GAS, 810 South Spring St., Los Angeles, Calif.

Charles W. Person Director of Publicity, Advertising for A.G.A.

CHARLES W. PERSON has been appointed director of publicity and advertising at American Gas Association headquarters, according to announcement by Alexander Forward, managing director. Mr. Person will work closely with the newly created General Committee on Publicity and Advertising, whose chairman, Mr. Henry Obermeyer, Consolidated Gas Co. of New York, is a member of the Executive Board.

Mr. Person was formerly with the Association for a number of years and now returns to it. He is well known to all advertising and publicity men in the public utilities field.

The American Gas Association Monthly will be edited under Mr. Person's direction by James M. Beall, for five years a member of the Association's headquarters staff.

Wisconsin Research Committee Surveying Company and Municipal Reports

G. V. Rork, president of the Wisconsin Utilities Association, Milwaukee, has appointed a Research Committee to serve the Association for the following year. At its first meeting the committee decided to appoint a competent individual to compile basic statistics from the annual reports filed with the Public Service Commission by companies and municipal systems. The committee is requesting members to provide physical and service information on municipal plants in the Association area.

More Reserves for Line to Salt Lake City

The Mountain Fuel Supply Co., Rock Springs, Wyo., has begun activity on the Clay Basin structure in Daggett County to develop gas supply for the Utah Gas & Coke Co.'s natural gas distribution system in Salt Lake City, Utah.

The Clay Basin is 20 miles west of the Mountain Fuel Supply Co.'s gathering system on West Hiawatha Dome, and 14 miles southwest of the Uinta Pipe Line Co.'s main 16-inch pipe line extending from the Hiawatha field to Salt Lake City.

Minnesota Valley Natural Gas Co. Project Goes Forward

Northern Natural Gas Co., Chicago, Ill. has completed 18 miles of the 50-mile, 6-inch natural gas pipe line which the company is constructing from a point on the main line just north of Faribault to provide gas supply for the Minnesota Valley Natural Gas Co., newly organized distributing unit headquartering in St. Peter, Minn. The company recently added Jordan, Minn., to the group of towns to which it will render service. R. E. Crawford is president of the new utility.

Newly Organized Pipe Line Co. Begins Construction

The Brookover Gas Co., Graham, Texas, recently organized, has begun construction of a 22-mile, 2-inch natural gas pipe line from the Nash & Windfohr field from which it will receive its supply to furnish other companies fuel for oil field use. W. B. Brookover is president of the company.

Minneapolis-Honeywell Co. Combines Humidity and Temperature Controls

THE Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., has added to its line of air conditioning products a new humidity and temperature control. The new model is housed in a case 6 inches high, 3½ inches wide and 2½ inches deep. Heretofore

it has been necessary to have two instruments of approximately this size to perform the same functions.

In the thermostat of the control the bimetallic actuating element tips a mercury switch which makes or breaks the circuit as required to turn heat on or off. It can be used on either low or line voltage circuits and operates on a temperature change of less than 1 degree above or below the setting. The actuating element of the humidity control is human hair, which tips a mercury switch capable to handling either low or line voltage current. The instrument is designed to control to within 2 per cent relative humidity under normal rate of humidity change.

Settings for temperature and humidity are made with small knobs on the front of the instrument. The temperature range is from 60 to 80 degrees F., and the humidity setting is for 20 to 80 per cent relative humidity. The instrument is available either with or without the humidity indicator scale.

Central States Power & Light Organization Changes

B. F. Pickard, general manager of the Central States Power & Light Corp., Tulsa, Okla., was appointed vice-president of the company in August.

E. C. Brown, assistant treasurer of the company, has been transferred from the Dubuque, Iowa, office to Tulsa, where he is in charge of the general accounting department which was recently moved from Dubuque to the headquarters office at Tulsa.

Reduced Rates for Madison, Wis.

The Madison Gas & Electric Co. was ordered by the Public Utility Commission of Wisconsin to reduce its gas and electric rates effective August 21. The annual reduction will amount to $181,900 and follows a $200,000 reduction which became effective in 1932. The Madison Gas & Electric Co. will not contest the order at present, according to R. B. Brown, president of the company.

Rankin, Texas, Awarded PWA Fund

Rankin, Texas, has been awarded $25,700 by the Public Works Administration for the construction of a natural gas transmission line and distribution system.

Wis. Utilities Asso. Commercial Section Meeting September 10-11

THE gas division of the Wisconsin Utilities Association's Commercial Section will meet in joint and parallel sessions with other Commercial Section divisions of the Association in Milwaukee on September 10 and 11, for the Section's first convention in two years. Hotel Pfister has been chosen as headquarters for the two-day conference.

Topics included in the program for the gas division meeting the afternoon of the first day include Kitchen Modernization, Cooking for Profit, New Methods in Water Heating, Air Conditioning, Refrigeration, and Merchandising of Gas Ranges.

A. C. Davey, Oshkosh, Wis., is chairman of the Commercial Section; H. B. Hummell, manager of the Wausau Gas Co., is chairman of the gas division, and A. F. Herwig is executive secretary of the Association, which maintains headquarters in Milwaukee.

Convention arrangements include a manufacturers exhibit, for which T. A. Coffin of Milwaukee Electric Railway & Light Co. acted as committee chairman.

American Delegates Sail for Zurich Gas Conference

Four American delegates to the Second International Gas Conference, to be held in Zurich, Switzerland, September 1-4, sailed from New York on August 14 and 15. Clifford E. Paige, vice-president and chief engineer of The Brooklyn Union Gas Co., and Alexander Forward, managing director of the American Gas Association, sailed on the S.S. Statendam, August 14. Mr. Paige will present a paper on "Coordinated Research and Coordinated Rate Making" at the conference. W. Reed Morris, vice-president of the Koppers Gas and Coke Co., Kearny, N. J., sailed on the S.S. Manhattan, August 15, and Hilmar Papst, vice-president and general manager of the Portland Gas and Coke Co., Portland, Ore., sailed the same day on the S.S. Hamburg. Mr. Papst plans to visit relatives in Germany before returning to the U. S.

Sales Manager For Byllesby Engineering and Construction Dept.

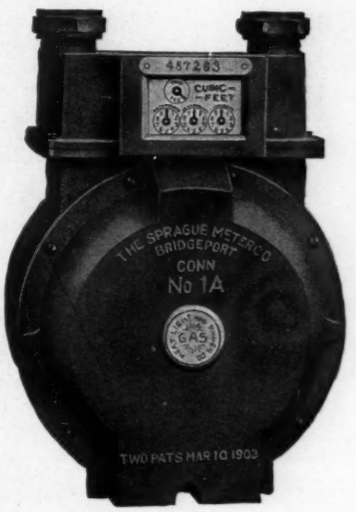
Kenneth Williams has been appointed manager of sales for the department of engineering and construction of the Byllesby Engineering and Management Corp., Chicago, Ill., according to H. W. Fuller, vice-president in charge of that department.

The engineering department of the Byllesby corporation also announces the expansion of its activities to include general engineering practice for independent clients, after having for many years confined its services to subsidiaries of Standard Gas and Electric Co.

Citizens Gas Co. to Add 500 Customers in Parsons

Citizens Gas Co., Parsons, Kan., has announced an expansion program which will add 500 additional customers to the original 400 which the company began serving in 1933. Citizens Gas Co. is an affiliate of the Ozark Pipe Line Co., Parsons, Kan., which supplies natural gas to the Citizens company from its field southwest of Parsons. A. S. Hopkins is president and S. H. Hale, general manager of both companies.

"MODERNIZE as you repair"



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SATISFIED CUSTOMERS

■ Keep your customers satisfied by recommending and installing the Chronotherm*... the greatest achievement in the field of automatic heating. It provides unvarying temperatures and will entirely eliminate "Cold 70°", and save fuel by doing so. Minneapolis-Honeywell Regulator Co., 401 East 28th Street, Minneapolis, Minn.

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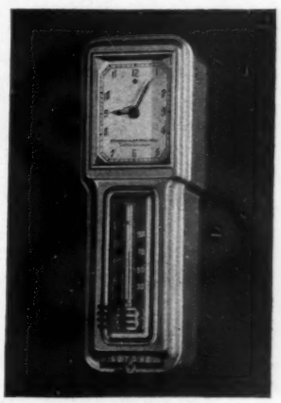
MINNEAPOLIS-HONEYWELL

Control Systems



The Chronotherm*... Provides absolute unvarying temperatures and eliminates "Cold 70°".

* *Formerly called Thermochron.*

NRA MEMBER U.S. WE DO OUR PART

The heater that smiles while it warms

FRASER

Radiant Front Console

Imagine a circulating heater with all the added advantages of a cheerful open fireplace. It is absolutely new—a revolutionary contribution to gas heating.

Manufactured by

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The reason for the long life and low maintenance cost of cast iron pipe is its effective resistance to rust. Cast iron is the one ferrous metal for water and gas mains, and for sewer construction, that will not disintegrate from rust. This characteristic makes cast iron pipe the most practicable for underground mains since rust will not destroy it.

For further information, write to The Cast Iron Pipe Research Association, Thomas F. Wolfe, Research Engineer, 309 Peoples Gas Bldg., Chicago, Ill.

CAST IRON PIPE

Look for this Trademark

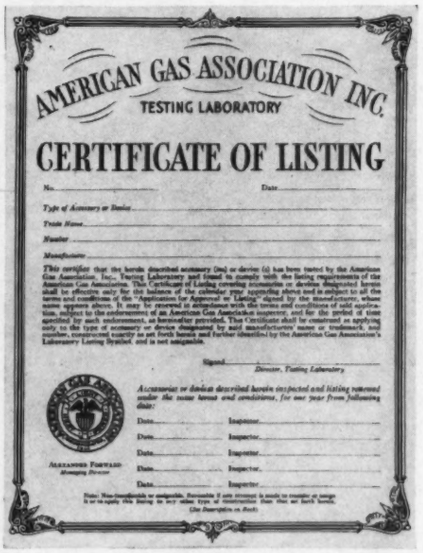
Tests for Regulators and Appliance Accessories

WITH the recent completion of the new Listing Requirements for Gas Appliance Pressure Regulators, manufacturers of such equipment may now submit their regulators to the A.G.A. Testing Laboratory for tests and listing. Manufacturers whose equipment is tested and found to comply with the requirements will be granted a certificate of listing and the right to affix the Laboratory's Listing Symbol to their regulators. The Listing Symbol comprises the letters "A.G.A." Details regarding the marking of regulators will be found in the regulator standards and in the "A.G.A. Requirements for Official Marking of Approved Gas Appliances and Appurtenances, and Listed Accessories."

A reproduction of the Laboratory's new "Certificate of Listing" is shown above.

Copies of the Listing Requirements for Gas Appliance Pressure Regulators and the requirements for official marking, as well as information regarding test procedures, may be secured upon application to the Director of the American Gas Association Testing Laboratory, 1032 East 62nd Street, Cleveland, Ohio.

Attention is also called to the expansion of the A.G.A. Laboratory's testing and certification program to include gas burner valves and other types of gas appliance accessories. Standards for gas burner valves applying not only to gas cocks of the plug and barrel type, but also to flat-faced or rotor-disc types, were recently completed by the Association, constituting the first complete standards for such equipment ever developed. Manufacturers of such equipment may now submit their products to the Laboratory directly for tests and certification.



AMERICAN GAS ASSOCIATION INC.
TESTING LABORATORY

CERTIFICATE OF LISTING

Heretofore it has been possible for accessory manufacturers to secure only secondary recognition of their products by the A.G.A. through submission of such equipment for test as a part of a complete gas appliance tested for approval.

Natural Gas Mixture for Omaha in September

Northern Natural Gas Co. will begin service of natural gas to the Metropolitan Utilities District of Omaha about the middle of September, in execution of a contract with the Utilities District, whereby natural gas will replace oil in bringing the content of water gas produced in the district to 550 B.t.u.

The new service requires the construction of approximately 3 miles of 18-inch pipe line. Changes are now being made in the gas plant to accommodate the fuel. T. A. Leisen is manager of the Omaha Metropolitan Utilities District.

Quarterly Sales Meeting Held By Southern Counties Gas Co.

Southern Counties Gas Co., Los Angeles, Calif., held its quarterly sales meeting August 21, a feature of the evening being the three-minute public speaking elimination run-off for contestants to represent Southern Counties at the Pacific Coast Gas Association convention contest this month. Clara McGuire, Monrovia district, was the winner in the women's division; and Leighton T. Burse, Santa Ana, will represent the company in the men's finals.

Company executives present at the meeting included President F. S. Wade and Vice-Presidents A. F. Bridge, M. R. Thompson, and Norman R. McKee.

The company's 1934 appliance sales were reported 50 per cent ahead of 1933 at this time, according to Clyde H. Potter, commercial manager, who presided at the sales meeting. The company has just concluded a satisfactory refrigeration season and is entering its annual house heating promotional drive.

Capt. A. E. Higgins, field representative of the American Gas Association and secretary of the Natural Gas Department, spoke before the meeting, commenting optimistically on the outlook for natural gas sales nationally.

Okla. City to Vote On Municipal Plant October 2

Oklahoma City, Okla., has called an election October 2 on a $4,000,000 bond issue for construction of a municipal gas distribution system.

The franchise of the Oklahoma Natural Gas Co., Tulsa, now serving Oklahoma City, expires October 31, and the company has made application for a franchise election on November 20 to decide on renewal of the franchise, regardless of the outcome of the October 2nd election.

1,000 Visitors a Day See Electrolux At Fair

Electrolux Refrigerator Sales, Inc., New York, N. Y., reports an average of 1,000 visitors a day to the company's Chicago World's Fair exhibit located in Home Planning Hall. Electrolux gas refrigerators are on display in the Baby Incubator exhibit and the Emergency Hospital, in addition to being included in each model kitchen display in Home Planning Hall.

Welsbach Co. Makes Executive Appointments

The Welsbach Co., Gloucester, N. J., announces the following changes in its executive personnel. H. N. Ramsey has been elected president, succeeding H. R. Martz, resigned. C. A. Holdcraft succeeds A. L. Fowler as treasurer. Messrs. Martz, Fowler and W. Findley Downs have retired from the board of directors, vacancies being filled

F. A. Wegener

H. N. Ramsey

by the election of Messrs. Ramsey, H. W. Reed and F. A. Wegener.

Mr. Ramsey, who was graduated from the University of Pennsylvania in 1920, has previously been engaged in engineering and executive activities with the American Gas Co., The U. G. I. Co., Dwight I. Robinson & Co. and United Engineers & Constructors, Inc., and in addition to his wide engineering experience brings to the company a well rounded business training.

Mr. Wegener, in addition to election to the board, was appointed general manager. A graduate of Columbia University, he has been associated with the company for over 21 years, serving successively in the capacity of assistant master mechanic, works engineer, and, since 1922, chief engineer. As chief engineer he has become well known in the industry for the development and design of the many gas appliances and devices produced by the company.

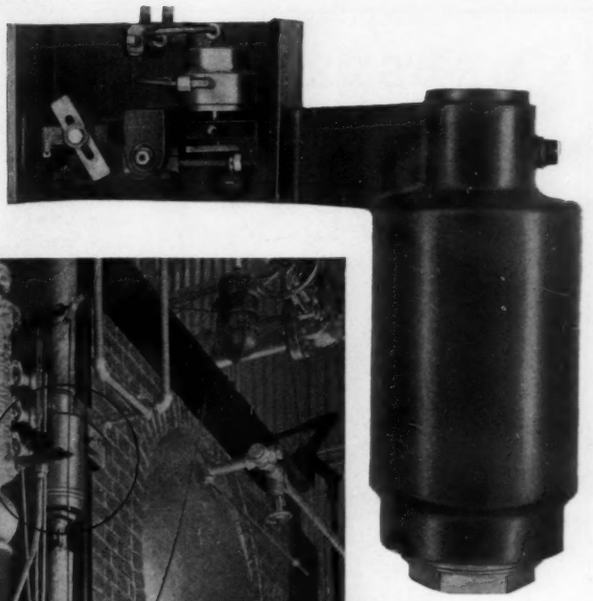
Muskogee Natural Gas Inc. Permitted to Suspend Operations

The application of Muskogee (Okla.) Natural Gas Inc. to suspend gas service in the city of Muskogee was granted a hearing before the Oklahoma Corporation Commission. It was shown that all customers of the company would be served by the Oklahoma Natural Gas Co. or the Municipal Gas Co. of Muskogee. The Muskogee Natural Gas Inc. has been serving a limited number of commercial and industrial accounts in Muskogee for the past five years. Late in 1933 capital stock of the company was acquired by the Oklahoma Natural Gas Co., Tulsa, Okla., which serves the majority of Muskogee consumers.

Hickok Oil Corp. Applies For Eastland, Texas Franchise

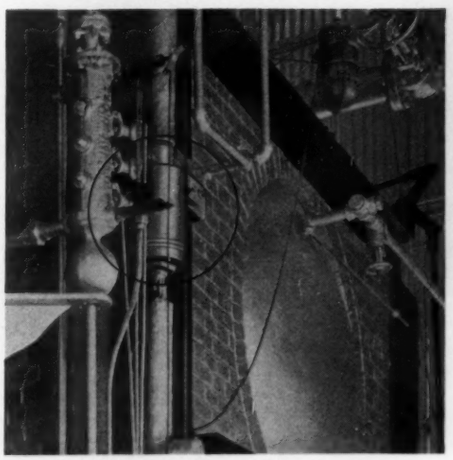
Hickok Oil Corp., Toledo, Ohio, through its subsidiary, the Eastland Fuel Corp., has applied for a franchise to install and operate a natural gas distribution system in Eastland, Texas.

The company recently was granted a franchise to serve natural gas in Cisco, Texas, and is at present constructing a distribution system there.



N. G. E. PRODUCTS INCLUDE:

N.G.E. Gas Burners
N.G.E. Liquid Level Controllers
N.G.E. Wilgus Gas Fuel and Pressure Regulators
Webster Radiant Gas Burners
Surface Combustion Industrial Furnaces
Janitrol House Heating Machines



Installation of N. G. E. Feed Water Regulators on 250 HP Water Tube Boiler

Constant Water Levels—Uniform Feed Flow

with **N. G. E. Feed Water Regulators**

The N. G. E. column float type feed water regulator is very positive in its function of holding a constant water level and a uniform flow of feed water to the boiler. The controller has a range adjustment which enables adapting it to the load requirements. The advantage of this adjustment is that a more uniform flow of feed water to the boiler can be maintained under severe changing load conditions. Where operating conditions are steady, a very close water level can be maintained with equal uniformity in rate of feed water.

The complete controller comprises the new design column float liquid level controller and N. G. E. Precision pilot which actuates a Wilgus-N. G. E. motor valve in the feed water line to the boiler. About 10 pounds of air or gas pressure is required for pilot supply medium. The float has an abundance of power compared with its only function, that of operating the frictionless N. G. E. Precision pilot. The pressure thus created by the pilot is transmitted to the diaphragm valve, giving it ample stroke and a full throttling action.

NATURAL GAS EQUIPMENT INC.

Petroleum Securities Bldg. Los Angeles | 1123 Harrison Street San Francisco | Arizona Distributors: Crane Co.

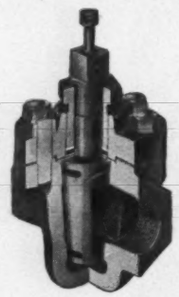
LOOK TO THE PIONEERS FOR CONTINUED LEADERSHIP

GENERAL CERAMICS COMPANY
• REFRACTORIES •

General Ceramics Refractories are made to exacting standards of accuracy and uniformity. That is why they are being used by the leading manufacturers of conversion burners, space heaters, and circulating heaters. Our engineers will gladly cooperate on new designs, alterations, production economies, etc.

General Ceramics Company, 71 West 35th Street, New York

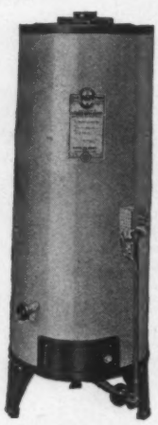
NORDSTROM
Lubricated
PLUG
VALVES



Cut-away view of Nordstrom Lubricated Plug Valve. Made in sizes from 1/2" to 30", in various metals. Also made with face-to-face dimensions same as gate valves, 2" to 12" permitting installation without altering pipe dimensions.

MERCO NORDSTROM VALVE CO.
A Subsidiary of
PITTSBURGH EQUITABLE METER CO.
Main Offices: Pittsburgh, Penna.
Branch Offices, Warehouses in Principal Cities

HIGH QUALITY—LOW PRICE



AGP
AUTOMATIC
STORAGE GAS
WATER HEATERS

Three models of quality water heaters at a price range to meet any campaign requirement. Each combines the highest efficiency with improved principles of design and sturdy construction. Perfectly controlled, highly efficient, yet lowest in price for comparable quality.

A. G. P. made in galvanized or Everdur tanks—20-25-30-40-75 gallon sizes.

A. G. P. SPECIAL made in galvanized tanks—20-25-30-40-75 gallon sizes.

THE DICTATOR Low-Priced Water Heater is made in galvanized or Everdur tanks—15-20-30-40 gallon sizes.

Write for Literature:

AMERICAN GAS PRODUCTS CORPORATION
40 West 40th St., New York, N. Y.
Division of
AMERICAN RADIATOR COMPANY

Friction Factor for Stanpac Natural Gas Line

(Continued from Page 17)

$$f = \frac{(3600)(519.6)\ D^5\ Y}{Q_e^2 L\ S\ T}\ (P_1^2 - P_t^2) \qquad (5)$$

The quantities of gas flowing in each section between taps were taken from the meter records for the deliveries at these various points and at the terminus, and are corrected for temperature, pressure, and deviation, to volumes at 60° F. and 30 inches Hg. The pressures and temperatures were taken from the records of the metering stations at the two ends of the line. The temperature of the gas flowing in the line was assumed to be uniform throughout its length; no consideration was given to the difference in temperature existing in the sections between taps. The range of average temperatures, covered by the data selected, has been from 57 to 84° F. The gas usually reaches ground temperature within the first 30 miles. The recording thermometers at both ends of the line are somewhat affected by atmospheric temperature but are as good as the usual commercial installation. In order to compensate somewhat for the differences in temperature at the two ends of the line an average temperature for each calculation was obtained from the following relation:

$$T = (4\ T_t + T_1)/5$$

In which

T = Average temperature, °F. abs.

T_1 = Inlet temperature, °F. abs.

T_t = Terminal temperature, °F. abs.

This averaging procedure takes into account that the gas reaches ground (or terminal) temperature in 1/5 of its length, 4/5 of its length being at the terminal temperature.

The factors for deviation from Boyle's Law were taken from data obtained by P. E. Beckman, using an improved apparatus. This apparatus is described in an article appearing in *Western Gas,* August, 1932, in which is also mentioned the advisability of applying deviation corrections to pipe line problems when accuracy is desired. The deviation factor employed is defined as the ratio of the product of pressure and volume (P V) at 14.73 lbs. per sq. in. to the product PV at line pressure, for a given weight of gas. The deviation factors are correlated with the average temperature and pressure of the line as a whole. It would have been possible to apply the effect of temperature and deviation to the flow in each section between taps by adjusting the "equivalent lengths" to compensate for them. However, investigation revealed that this laborious task was unwarranted since the effect on the friction factor was insignificant.

For the period of time selected, the average pressures at the inlet and outlet have been 381 and 207 lbs. per square inch gauge, respectively, the average drop in pressure from inlet to outlet having been 174 lbs. per square inch.

Periods of time were selected during which the flow was considered sufficiently stable so that no appreciable error would be introduced by pack or draft on the line. Records were used only for such intervals as when the pressures at the two ends of the line remained constant for at least five hours, and no wide fluctuations had occurred during the previous five hours.

The friction factors obtained are plotted chronologically in Fig. 3. It will be noted that there are four groups of values. Those of 1930 and 1931 are for a period when the internal surface of the pipe had not yet become corroded. The line was placed in operation in May, 1930, and the upward tendency of the friction factor was not revealed until late in 1931. It then rose until it reached its peak in July and August of 1932.

At the time marked "A" in Fig. 3 the first 40 miles of the pipe line were blown and a number of new drips installed. Considerable water was removed and from the last 10 miles of this section some dust was obtained. This had very little effect upon the friction factor. At the time marked "B" this section of the line was again purged, but a bundle of heavy, steel lathe turnings was dumped into the line before the purge. Sweeping the line with these turnings was effective in removing scale and dirt. During this purge large quantities of scale and, in one section, considerable mud was blown. Subsequent to this blow the friction factor dropped somewhat. At the time indicated by "C" a new outlet line at the Kettleman Compressor Station was installed. This line by-passed a large portion of the gas around the moisture separator which had previously carried all the load, but at about two or three times its rated capacity. Undoubtedly a considerably greater quantity of water was being carried into the transmission line after this line was installed, and although the friction factor increased it did not return to the peak of 1932. At the time marked by "D" the first 50 miles of the line was again purged, using lathe turnings, and considerable quantities of material were removed from the pipe. This, however, did not compare with the amount obtained on the second blow in 1932. At the time indicated by "E" an additional moisture separator was installed upon the second Kettleman Compressor Station outlet. Following this installation the friction factor decreased considerably. The installation of additional cooling equpiment is now contemplated, although the amount of water delivered to the line is much less at the present time than at any time since January 1, 1932.

In Fig. 4 the friction factor is plotted against Reynolds' number, $d\,u\,s/z$, in which (d) represents the diameter in feet, (u) the velocity in feet per second, (s) the density in pounds per cubic foot, and (z) the viscosity in pounds per foot-second. The viscosity of the natural gas was based upon data from Trantz and Sorg. Ann. d Physik *10,* 81, (1931). Since the average temperature of the gas in the pipe line varied only from 57 to 84° F., the viscosity for the average temperature of 68° F. was used, being .0000071 lbs. per foot-second. Curves from tests by Dr. Lacey[1] and Berwald and Johnson[2] have been included for comparison.

As stated above, the corrosion, causing roughness of the pipe, was confined to the

first 25 miles. The character of this roughness is described by Geo. H. West, consulting chemical engineer, in a report on the investigation of the cause and extent of the corrosion. From this description it is evident that the roughness produced varied from an even coating about 1/32 inch thick in the first few miles, to blisterlike bubbles 1/16 inch to ⅛ inch in diameter in the remainder. These blisters projected inwardly about 1/16 inch, and had a wall thickness of 1/100 inch covering the upper half of the pipe. In some locations blisters as large as 5/32 inch, extending ⅛ inch inward, covered the upper part of the bottom quarter of the inner circumference. In all except the first few miles there was a fairly clean water channel on the bottom of the pipe. This varied in width from 2 to 8 inches, depending upon the location with reference to the drips and the point of greatest rate of condensation.

Considering that the corrosion was confined to approximately the first quarter of the equivalent total length of the line, the peak friction factor (.0042) for the line as a whole corresponds to a friction factor of .0075 for the corroded section. It is believed, however, that a large portion of the resistance was due to the presence of the water itself rather than the actual roughness of the surface. For a period including only the last five months shown in Fig. 3, the average friction factor for the line as a whole is about .0034, and the corresponding friction factor for the corroded section must therefore be .0043. This is a reasonable factor for the character of the surface of the pipe at present, since it corresponds very well with the curve "A" in Fig. 4 for clean cast iron pipe. It is believed that, had no corrosion occurred and had only clean dry gas been transported, the friction factor for this line would have continued to be in the order of .0031 as was obtained during 1930 and 1931.

1. The Economic Aspects of High Pressure Distribution, before the Institute of Gas Engineers (English) in 1928.

2. Factors Influencing Flow of Natural Gas Through High Pressure Transmission Lines. Bureau of Mines Bulletin R.I. 3153 (Dec., 1931).

Penn Temtrol Pomotional Activity Under Way

As part of a national advertising and promotional program in connection with the new Penn Temtrol System of temperature regulation, Penn Electric Switch Co. of Des Moines, Iowa, is holding a series of meetings over the country to which gas heating men and members of the automatic heating industry are invited.

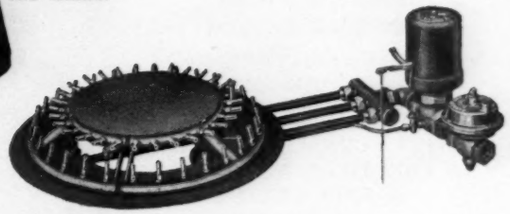
Meetings were held during August in Minneapolis, Milwaukee, Chicago, Detroit, Cleveland and Rochester and are scheduled for Omaha and Kansas City early in September. The meetings feature a dramatic presentation showing how Temtrol operates and its advantages. They are held under the direction of Nelson B. Delevan, sales manager of the company.

New Manager at Okemah, Holdenville

F. T. Atchison, manager of the Central States Power & Light Corp. at Okemah, Okla., has been transferred to the Holdenville office and will be succeeded at Okemah by Seth Thomas who has been the company's manager at Stillwater.

BARBER AUTOMATIC BURNERS

Illustrating No. 324-B Barber Automatic Burner installed in a round boiler. Note its simplicity of installation and the excellent scrubbing action of the flame.



Our Engineering Department will gladly furnish you practical, as well as technical co-operation in specifying Barber Burner Assemblies to especially suit and fit the grate areas for which they may be required.

WRITE us today for our NEW CATALOG and our latest attractive DISCOUNTS. Let us tell you how we assist with literature and co-operation that will help you to capitalize on the demand for Barber Automatic Heat.

THE BARBER GAS BURNER CO.

3704 SUPERIOR AVE. CLEVELAND, OHIO

ISLAS Coronado RESORT
THE NEWEST of the smart Mexican resorts. On an Island twenty-two miles by boat from San Diego. The ISLAS CORONADO YACHT CLUB, Coronado Islands, Mexico, offers a splendid retreat where you can thoroughly enjoy yourself. A favorite fishing ground for barracuda, yellowtail and tuna. Swim in the warm crystal waters of beautiful Coronado Cove. Hike over the island discovered by Coronado in the 14th century, where for over one hundred years buccaneers cached their plunder from the Spanish galleons.
CASINO · BAR · DANCING
Room, meals and round trip by boat from San Diego as low as $4.00 single--$6.50 double. Accommodations by reservation only. Telephone Los Angeles, MUtual 8593; San Diego, Main 6877 or write, 1050 Harbor Street, San Diego.
AN ISLAND FOR YOUR PLAYGROUND

NEW *Sales Literature*

Now Available!

Pacific
GAS HEATING HEADQUARTERS

Our Line for 1934!

- **FLOOR FURNACES**
  - **CABINET HEATERS**
    - **WALL HEATERS**
- **GAS STEAM RADIATORS**
  - **RADIANT HEATERS**
    - **WATER HEATERS**
- **GRAVITY FURNACES**
  - **FORCED AIR FURNACES**
    - **UNIT HEATERS**

The Outstanding Gas Appliance Line of the Pacific Coast. Write for complete information on any or all items . . .

Pacific Gas Radiator Co.
Main Office and Factory
Huntington Park, California
Oldest and Largest Manufacturer of Gas Heating Appliances in the West

STOP

THIS

During the past fifteen years, hundreds of miles of line have been coated and protected with NO-OX-ID. Underground pipe, badly pitted at the time it was cleaned with hand scrapers and coated years ago, when NO-OX-ID was going through its "test period" is still in service.

NO-OX-ID is low in cost because of the greatly extended period of protection it gives.

Dearborn field men are experienced in the industry. Complete data, recommendations and estimates supplied for both new and reconditioning work.

DEARBORN CHEMICAL COMPANY
LOS ANGELES:
807 Mateo Street, Phone TRinity 3385
SAN FRANCISCO
421 Bryant St., Phone SUtter 8688

NO-OX-ID
IRON RUST
The Original Rust Preventive

Cashing in on Distribution Employee Contacts

(Continued from Page 13)

This work has been valuable, measured in terms of actual results as indicated by appliance sales. The company is not engaged in the sale of appliances—all sales are through dealers. Prospects for new appliances, disclosed by the service contact men, are cleared through the New Business Department to dealers. As a direct result of employee tips, over 1,000 new appliances—ranges, water heaters, or space heaters—have been reported as sold since the first of the year. No doubt many other sales have occurred which have not been reported, and purchases are frequently made direct by the consumer acting on the meterman's advice.

To get the employee interest in sales promotion is one task; to keep it active requires constant action. For this purpose there are various ideas. First we played up a slogan, "Get Your Prospect Today." This was printed on stickers and placed on the windshield of every meterman's car and in other conspicuous places. Large signs were printed and hung over the exit and entrance to the various yards of the Distribution Department branches.

After three months the slogan was changed to, "Build Today for Tomorrow." Now we are running a slogan contest among the employees.

Next, large prints of a gas holder were made and hung at each station. These holders started empty, the first of the year. A quota of 3,000 prospects for the year was necessary to fill, but by August the top of the holder was blown off, with prospects to spare.

A departmental monthly newspaper is published consisting of eight pages of features, all more or less sales slanted. The staff are employees of the Gas Distribution Department, and the "press" a mimeograph machine. This offers a clever way to reach the employees, keep them posted wih activities, give the benefit of the experience to others, and name the names of the outstanding employees.

A record is kept of each man's prospects submitted, and the final disposal or sale. This record is published from time to time, and functions like the box score at a ball game—keeps all engaged interested.

Employees have received recognition for outstanding work; some have taken advantage of the opportunity offered to demonstrate their value as salesmen, with the result that four metermen have been chosen as sales representatives for the New Business Department and assigned to districts. Others are candidates for promotion when the sales program expands to meet the threatened intensive electric sales campaign.

So far our activities have demonstrated by results that employees engaged on customer contacts are potential sales producers; that these contacts are valuable and a means of interesting consumers in the advantages of gas and the benefits of modern gas appliances; that metermen readily respond to the opportunity to improve their utility; that good has resulted to all concerned. The utility profits in the retention of business and the building of load, the consumer from better service and the purchase of modern appliances, the employee by the assurance of steady employment and opportunity for advancement. A new deal for all concerned!

Republic Supply Executive Heads Oil Equipment Group

J. A. Crawford, president of The Republic Supply Co. of Calif., Los Angeles, was elected president of the American Petroleum Equipment Suppliers Association at the Association's first annual meeting August 6-7, Colorado Springs, Colo. He automatically becomes chairman of the Code Authority under the Code of Fair Competition for the American Petroleum Equipment Industry and Trade. J. A. Geismar, vice-president of The National Supply Co., Toledo, Ohio, was elected vice-president of the Association, becoming vice-chairman of the Code Authority.

Mixed Gas Service Assured For Minneapolis Consumers

As a result of a reduction of approximately 5 per cent in rates by the Minneapolis Gas Light Co., subsidiary of the American Gas and Power Co., New York, N. Y., the city council of Minneapolis on August 17 adopted an ordinance which permits distribution of mixed gas in the city by Minneapolis Gas Light Co. The company intends to distribute a mixture of artificial and natural gas of 800 B.t.u. content, which will involve a saving of about $300,000 annually to consumers. Natural gas supply for the city will come from the Northern Natural Gas Co. system through a 20-mile line taking off the main line near Rosemont, Minn. The new pipe line, which will pass Fort Snelling enroute, will be of 16- or 20-inch pipe.

Distribution of mixed gas service would begin about January, 1935. The new ordinance covers a 10-year period, but is subject to rate revisions, made on the basis of production costs every four months. Provisions of the ordinance guarantee Minneapolis Gas Light Co., a net earning of $1,250,000 a year.

Code Compliance Certificates Not Required of Public Utilities

At the request of the Procurement Division of the Treasury Department, the National Recovery Administration has announced an order exempting public utilities from the requirement that they sign a certificate of code compliance in order to receive a government contract for utility service such as gas, electricity, etc. The order states that it had been found impracticable or impossible to obtain such certificates from many public service corporations in the absence of an approved code.

N. G. E. Column Float Type Feed Water Regulator

Natural Gas Equipment Inc., Los Angeles, Calif., has introduced a new column float type feed water regulator, to hold a constant water level and uniform flow of feed water to boilers. The controller has a range adjustment for adaptation to load requirements, maintaining a level within ¼-inch, or within wider ranges as required. The complete controller comprises the new design column type liquid level controller, the N.G.E. precision pilot, actuating a Wilgus-N.G.E. motor valve in the boiler feed water line. About 10 pounds air or gas pressure is required for pilot supply medium.

The new controllers are made in three standard lengths—4 inches in diameter by 8 inches long, 3 inches diameter by 16 inches long, and 2½ inches diameter by 30 inches long.

The N.G.E. precision pilot incorporated in the controller will operate remotely located diaphragm motor valves where this is desired.

Only Standards Covering Mechanical Refrigerators

The American Gas Association's recently completed approval requirements for gas refrigerators are the first complete construction and performance standards ever published for mechanical refrigerators. They are endorsed by the U. S. Bureau of Home Economics and the American Home Economics Association, through their representation on the American Standards Association Sectional Committee, Project 221, which developed them, and incorporate specifications for practically all of the features recommended by those organizations as desirable in mechanical refrigerators. Every feature from ease of cleaning to refrigerating capacity is covered by these requirements.

San Diego Consolidated Begins 3-Month House Heating Campaign

San Diego (Calif.) Consolidated Gas and Electric Co., in August began a three-month sales campaign on central gas heating appliances and floor furnaces. The company is offering a bonus of $12 to dealers on each installation of a 40,000 B.t.u. input furnace plus 30 cents per 1,000 B.t.u. additional capacity. Only A.G.A. approved appliances will be honored and installation must pass company inspection as to adequacy and workmanship. Bonuses received by dealers must be utilized toward salesmen's commissions and/or additional advertising during the campaign.

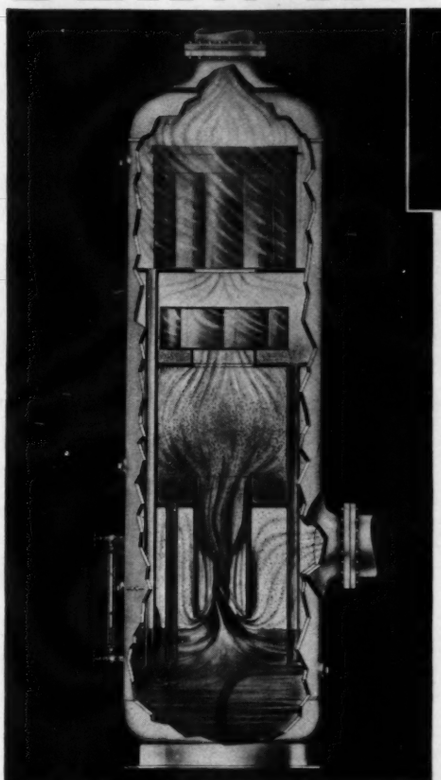
Natural Gas Change-Over Operations For Indiana Towns Start Sept. 1

Western Ohio Public Service Co., Greenville, Ohio, has plans under way for substituting natural gas for manufactured gas service in Portland, Winchester and Union City, Ind., according to C. E. Lakin, president of the company. Change-over operations are scheduled to begin September 1.

New Name for Wis. Utilities Publication

The name of the official publication of the Wisconsin Utilities Association, Milwaukee, has been changed to "The Utilitarian."

BLAW-KNOX



GAS CLEANERS

Deliver clean gas.

Remove all dust and liquid entrainment.

Operate without attention or shutdowns over long periods. Are capable of continuous operation.

Offer negligible resistance to gas flow.

Collected material is taken from path of gas flow and is quickly removable without shutting off gas flow.

Liquid contactor type.

BLAW-KNOX COMPANY
2033 Farmers Bank Bldg., Pittsburgh, Pa.

Electrogas Newest Development!

FURNACE - BLOWER - FILTER UNITS
with the application of ELECTROGAS STREAMLINE Principle.

Produced in all sizes available for commercial and domestic use.
Fitted with filters and slow speed quiet BLOWERS
Equal distribution of air over heating elements is assured by use of gang blowers.

ELECTROGAS FURNACE & MFG. CO.
2575 Bayshore Blvd.
San Francisco
164 South Central Ave.
Los Angeles

JOHNSON
No. 2 ADJUSTABLE
BUNSEN TORCH

Ideally suited for shop or laboratory use. Equipped with one No. 5 Type 'A" Bunsen Burner with shut-off valve and pilot light. An inexpensive and dependable torch for metal melting, soldering, and tempering. Removable top permits adjustment of torch to any desired angle. Torch may be removed from stand and used as an efficient hand torch. Write for details.

JOHNSON GAS APPLIANCE CO.
Cedar Rapids IOWA

Pacific Coast Representative—C. B. Babcock Co.
135 Bluxome St., San Francisco, Calif.

HIGHLIGHTS
ALL OF THE NEW GAS RANGES HAVE MANY SPECIAL FEATURES TO INTEREST YOU. THIS BURNER IS JUST ONE OF THE FEATURES...
See the New NON-CLOG BURNER
SIMMERING
USUAL COOKING FIRE
NOT FAST FRYING FLAME

Top Burner Control Stressed in Seattle Window

SEATTLE Gas Co.'s commercial department, of which J. Earl Jones is manager, reports that one of its current window displays, shown above, has proven an unusually good attention-getter. As may be seen from the illustration, the window is designed to feature the convenience and efficiency of the modern gas range as well as speed of cooking with gas. The particular theme is flexibility of top burner control. At the lower center of the display is seen a live demonstration of three burner operations, the efficient gas flame being shown at work under three Pyrex vessels. A black background is used behind the burners, making the flames easily visible and emphasizing the cleanliness of gas heat when supplied by modern gas ranges. The two ranges shown are of the current Magic Chef line, the one on the left being a clock-control-equipped model.

Ass't. Commercial Mgr. at Memphis

W. E. Parrott of the Memphis (Tenn.) Power and Light Co., has been made assistant commercial manager for the company.

Compact, Tamper-Proof Sturdy, Indestructible

FULTON Spring Type High Pressure REGULATOR

WHERE high pressure on a line makes it inadvisable to operate with a single regulator between line and user, the Fulton Spring Type High Pressure Regulator serves perfectly. Inlet pressures up to 300 pounds are reduced to any desired pressure between 10 and 50 pounds. Heavily and strongly built, yet this regulator is easy and economical to transport because of its compactness. It can be quickly installed and is very dependable in use. For exposed and out-of-the-way locations it is especially desirable because less subject to meddling than other types of regulators. Descriptive leaflet No. 118 is available. Catalog of Chaplin-Fulton regulators—40 types, for all requirements of gas control —will be mailed on request.

CF

The Chaplin-Fulton Mfg. Company

28-40 Penn Avenue **Pittsburgh, Pa.**

849 Employees Complete L.A.G. and E. Evening School Courses

Warren W. King, chairman of the Los Angeles Gas and Electric Corp. Employee Association's educational committee session for 1933-1934, reports an enrollment of 1945 in the Association's 36-week evening school, with 1215 completions made by 849 students. Completions were based upon a minimum of 70 per cent attendance. Certificates, totaling 911, were awarded to those fulfilling all requirements. Instruction on 42 subjects was given in 55 classes in the technical, cultural, morale, health, promotional or professional education fields. Thirty instructors were drawn from the Los Angeles Gas and Electric Corp. staff and outside educational centers. Five special awards were made to this year's honor students.

Educational facilities of the school have been extended to include employees of the Southern Counties Gas Co. and the Industrial Fuel Supply Co. Credits earned by students in the 1934-1935 evening school will be honored toward high school diplomas.

Direction of the L. A. G. and E. educational activities comes under the supervision of D. L. Scott, personnel manager.

Guthrie Okla. Would Condemn Gas Property

The city of Guthrie, Okla., through its attorney, Merle C. Smith, has started suit in the district court at Guthrie to acquire ownership of the Guthrie Gas Utilities Co. through condemnation and purchase. The city distribution system and pipe line to the Oklahoma City gas field was built by the Western Service Corp., and purchased at receiver's sale March 31 by E. R. Bahan, who formed the present company. The franchise granted to Western Service Corp. in 1931, and under which the Guthrie Gas Utilities Co. is now operating, gives the city the right to buy the property through the exercise of eminent domain.

Personnel Changes In New Orleans Public Service Organization

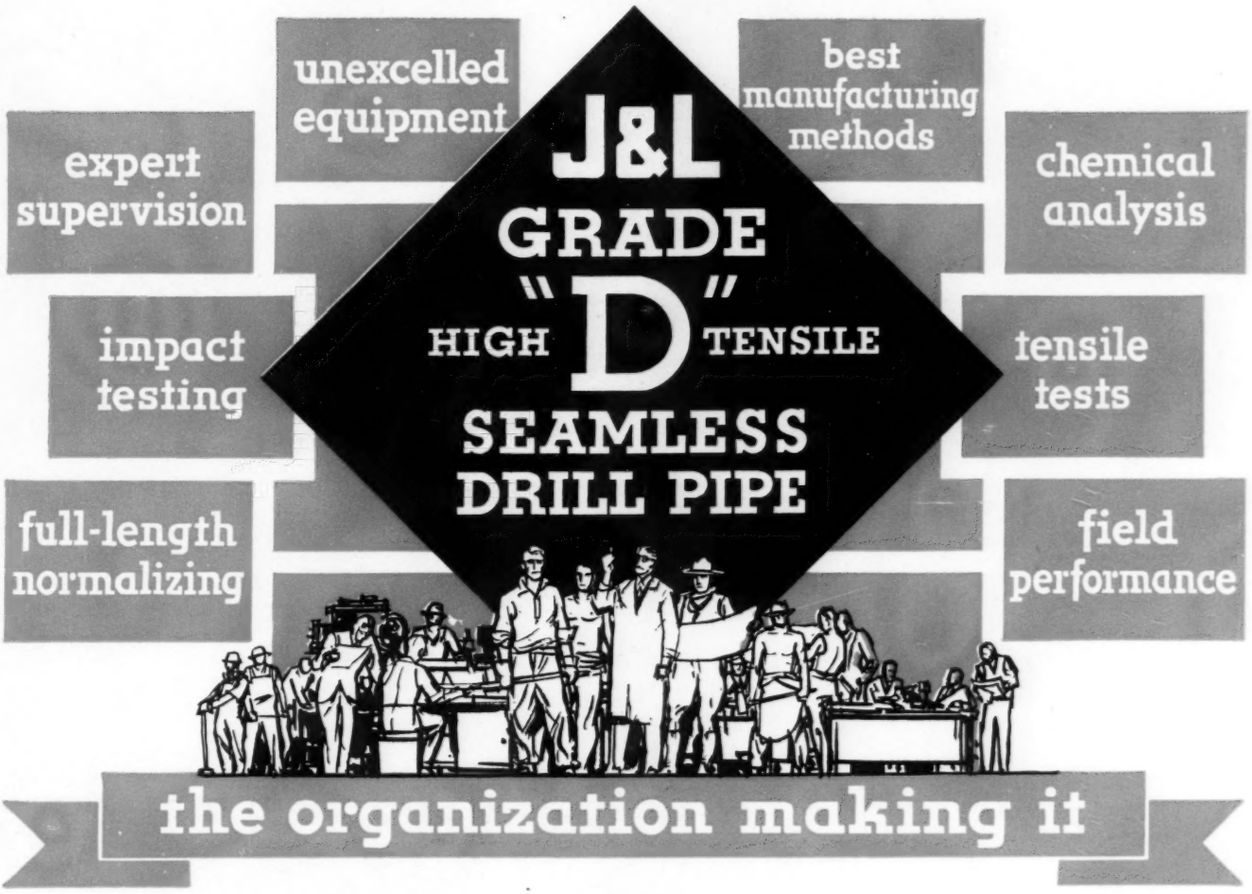
W. E. Clement, formerly commercial manager of New Orleans Public Service Inc., has been appointed director of commercial promotion and research for the company. H. E. Meade, assistant to the vice-president, has been made general sales manager, and will supervise the industrial and commercial service and the residential sales departments.

E. N. Avegno and S. L. Drumm have been appointed manager and assistant manager, respectively, of the residential sales department. H. H. Dinkins, Jr., former assistant manager of the industrial and commercial service department of the company has been made manager.

2700 Entries in Lone Star 30-Day Essay Contest

The Lone Star Gas Co.'s 30-day essay contest featuring "Why I Like a Modern Gas Kitchen" ended June 30 with a total of 2700 entries from company patrons. Prizes consisting of gas appliances, totaling $1,500 in value and offered in cooperation with gas appliance manufacturers, were awarded the 10 winners.

HERE'S WHY IT'S EXCEPTIONALLY GOOD DRILL PIPE



The performance which J & L Grade "D" High Tensile Interior Upset A.P.I. Seamless Drill Pipe has given, even under the most difficult conditions, is the result of manufacturing which is completely controlled and scientifically directed by Jones & Laughlin. ¶ Starting with the mining of ore and progressing through steel making, pipe making, testing and inspecting, every operation is performed by J & L men under J & L direction. There is no division of responsibility, no elements of uncertainty to affect the uniform excellence of the product. ¶ That is *why* J & L Grade "D" Drill Pipe is exceptionally good. Just *how* good it is, how it meets the exacting requirements of high-speed, deep-hole drilling, can be fully realized only after using it.

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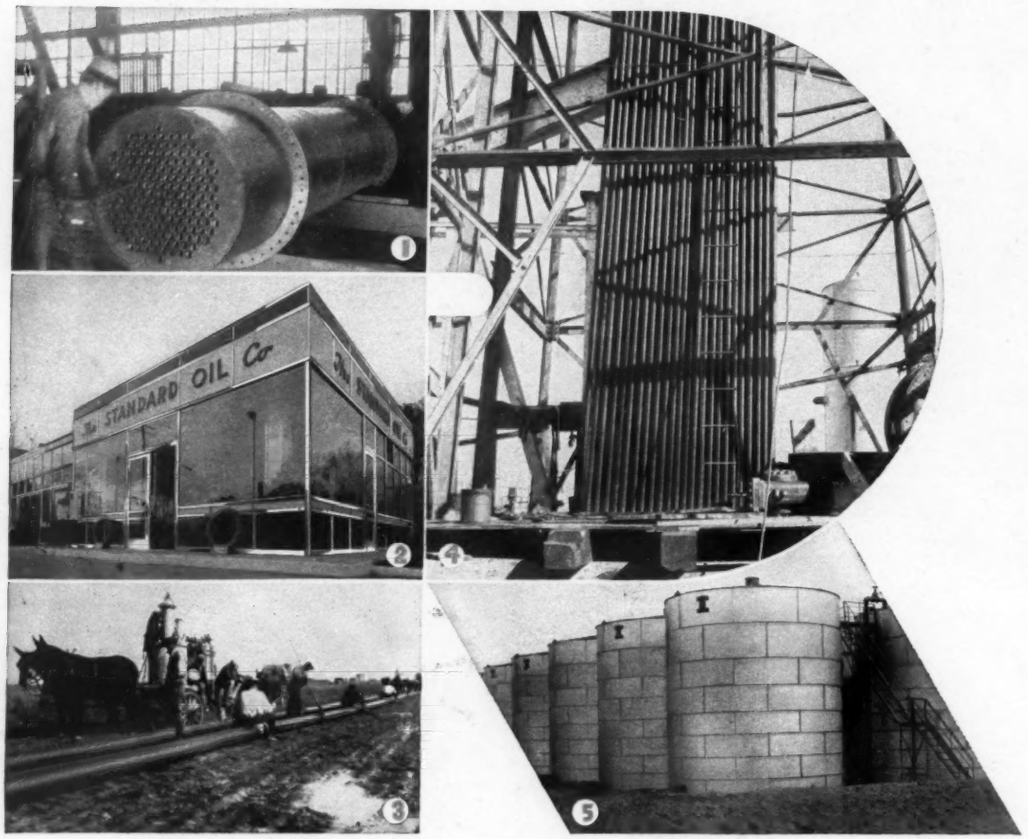

SERVING AN INDUSTRY THAT DARES NOT GUESS

1. *For heat transfer equipment, Electrunite Condenser Tubes, electric resistance welded, are ideal. Easy to roll in—uniform in every detail.*

2. *Modern service stations like this of the Standard Oil Company of Ohio are using Toncan Enameling Iron Sheets with Enduro, Republic's Perfected Stainless Steel, as decorative trim. Enduro will not rust, is easy to clean and outlasts the structure.*

3. *Thousands of miles of Republic Electric Weld Line Pipe have been laid for gas and oil lines in the last five years. This has been furnished in a wide range of diameters and wall thicknesses to meet economic needs of the industry.*

4. *Republic Electric Weld Casing and Tubing, grades C and D, are establishing new records where deeper wells demand the utmost in joint strength and in resistance to collapse.*

5. *Republic Plates and Upson Tank Bolts always produce a workmanlike tank—tight—safe—long lasting. Upson Bolts are available in all grades of steel, in Toncan Iron and Enduro Stainless Steel.*

Millions of dollars are spent annually by the producing, refining and transporting divisions of the petroleum industry for new equipment. Any failure of material is so costly that guesswork simply must be eliminated.

Sensing the changing demands of the industry, Republic long ago planned to keep a step ahead—to be a leader in the movement to substitute positive performance for the hazard of chance. Since then, from Republic's laboratories have come new wear-resisting Agathon Alloys to speed up drilling—new corrosion-and-heat-resisting alloys, Toncan Iron and Enduro Stainless Steels, to challenge salt-and-sulphur-laden crudes, and to bring safety to high-temperature operations—and a new method of making better casing, tubing and line pipe by Republic's now famous electric resistance welding process.

Republic has never been afraid to pioneer—to spend time and money in the development of better steels to meet the specific needs of this mammoth industry that can't afford to guess, yet must see that every dollar spent buys value plus.

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